NOTICE OF MEETING
HILLSIDE REVIEW BOARD
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH

Public Notice

Notice is hereby given that the Hillside Review Board of the City of St. George, Washington County, Utah, will hold a meeting at the reference site on **Wednesday, December 18, 2024**, commencing on site at 9:00 a.m.

The agenda for the meeting is as follows:

Call to Order
Call for disclosure of conflicts of interest

1. **CONTINUED ITEM: Canyon View Apartments –** This is a request to obtain a hillside permit for the property located at Canyon View Dr and Ostler Way. The applicants are proposing to build a new apartment development on this property. This property is in the hillside overlay. **Meeting time is approximately 9:00 am at Canyon View Dr. and Ostler Way.**

2. **Minutes**

   Consider a request to approve the meeting minutes from the November 20, 2024, meeting.

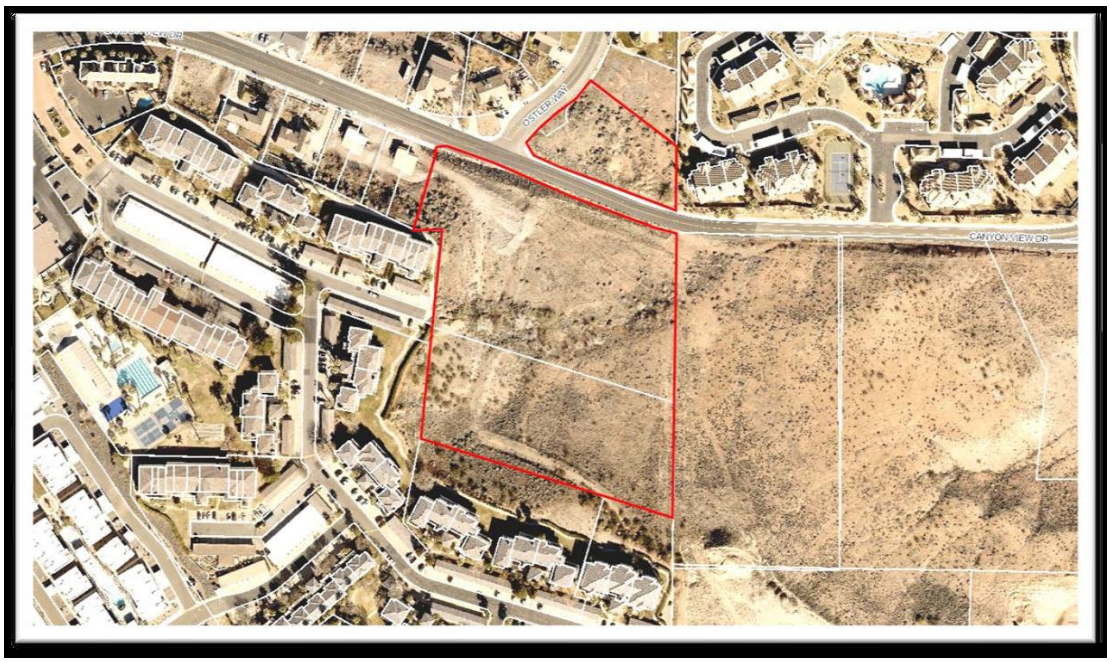
Monica Smith

Monica Smith – Development Office Supervisor

REASONABLE ACCOMMODATION: The City of St. George will make efforts to provide reasonable accommodations to disabled members of the public in accessing City programs. Please contact the City Human Resources Office at (435) 627-4674 at least 24 hours in advance if you have special needs.

Item # 1 Meeting Location

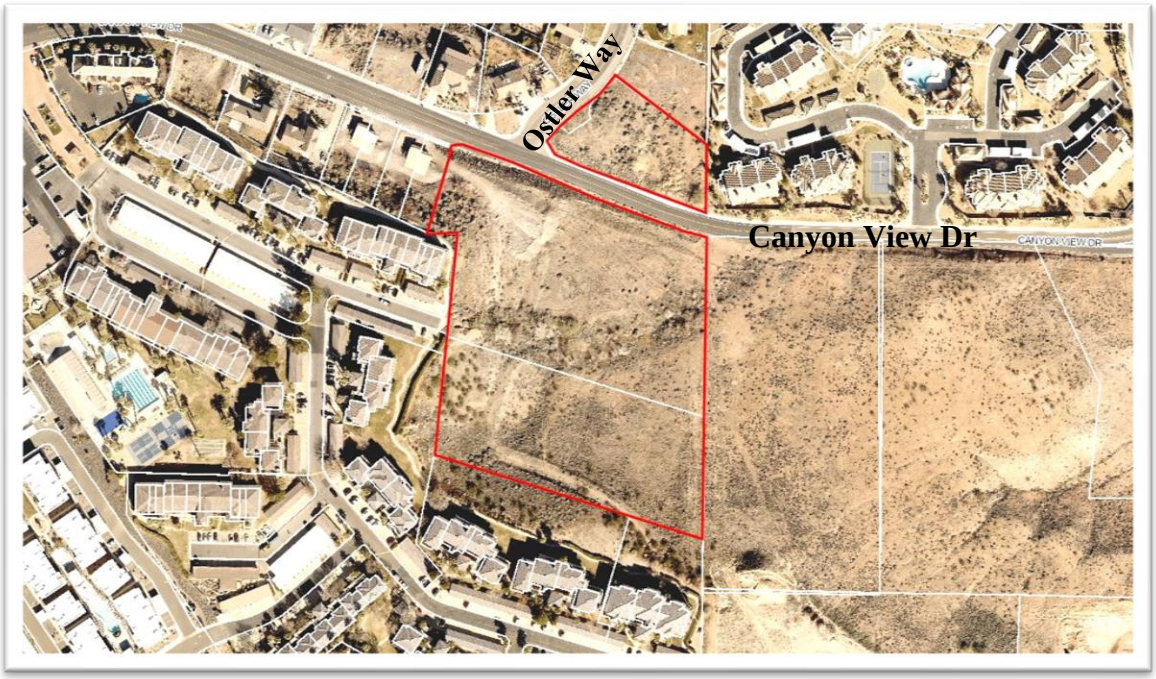
Canyon View Dr. and Ostler Way



ITEM 1
Hillside Permit

HILLSIDE REVIEW BOARD AGENDA REPORT: **11/20/2024**
HILLSIDE REVIE WBOARD AGENDA REPORT **12/18/2024**

Canyon View Apartments Hillside Development Permit (Case No. 2024-HS-004)		
Request:	A Hillside Development Permit to allow disturbance of slope areas greater than 20% and to determine natural vs man-made slope areas.	
Applicant:	Bush and Gudgell, Inc.	
Representative:	Rick Myer	
Location:	Canyon View Dr and Ostler Way	
General Plan:	HDR (High Density Residential)	
Existing Zoning:	R-3 (Multi-Family Residential)	
Surrounding Zoning:	North	R-1-10 (Single Family Residential, 10,000 ft² lots)
	South	PD-R (Planned Development Residential)
	East	PD-R (Planned Development Residential)
	West	PD-R (Planned Development Residential)
Land Area:	Approximately 7.51 acres	



BACKGROUND

This is a request to obtain a hillside permit for the property located at Canyon View Dr and Ostler Way. The applicants are proposing to build a new apartment development on this property. This property is in the hillside overlay. Section 10-13A-3 of the Zoning Regulations requires that all development on slopes above 20% requires a 'hillside development permit' granted by the City Council upon recommendation from the Hillside Review Board and the Planning Commission.

Hillside Review: This application was presented and discussed with the hillside review board on November 20, 2024. There was discussion about what slope areas were natural and which are man-made. Additional information was requested to ensure that slope disturbance of the project would meet City ordinances and would not negatively impact the slope at the west end of the project that has previously been reinforced for condominiums in the Las Palmas Resort. The item was continued so the applicant could gather additional information to help the board make a more informed decision.

Since the last hillside meeting, the proposed apartment project has been modified to reduce the amount of disturbance to natural slope areas. This was achieved by increasing the finished floor elevation by approximately 10 feet. The approximate amount of cut is reduced from 57,511 CU.YD. down to 16,290 CU.YD. Disturbance to slopes at the west and south sides of the project site is greatly reduced. With the proposed changes, the amount of disturbance within natural slope areas between 20% and 30% is approximately 29.9% which is less than the allowed limit of 30%. For areas of slope above 30% but below 40%, the amount of proposed disturbance is 0.3% which is less than the allowed 5% per City ordinance.

APPLICABLE ORDINANCE(S) *(Selected portions)*

10-13A-1: Density and Disturbance Standards

A. The hillside development overlay zone (HDOZ) limits development densities and provides specific development incentives to transfer underlying zone densities from hillsides (sending areas) to less steep slopes or more safe development areas (receiving areas), within a development.

B. For those portions of a proposed development with natural slopes twenty percent (20%) or less, development density follows the density and development standards in the underlying zone.

C. For those portions of a proposed development with natural slopes from twenty-one percent (21%) to thirty percent (30%), development activity shall not disturb more than thirty percent (30%) of the parcel within this slope category.

D. For those portions of a proposed development with natural slopes from thirty-one percent (31%) to forty percent (40%), development activity shall not disturb more than five percent (5%) of the area within this slope category.

E. A proposed development may not disturb slopes in excess of forty percent (40%).

10-13A-2: Slope and Slope Areas Determined

A. Slope shall be determined for each significant portion of development parcel.

B. *Procedure:* The applicant shall map the location of the natural slope by using the following procedure:

1. *Preparation of Contour Maps:* The applicant shall submit an accurate, current contour map, prepared and certified by a licensed professional engineer or surveyor, which shows all land contours at intervals no greater than five feet (5'), drawn at a one inch equals one hundred feet (1" = 100') scale maximum.

2. *Verification through Field Surveys:* The city engineer or designee may require the applicant to submit a field survey to verify the accuracy of the contour map.

C. *Determination of Slope Areas:* Using the contour map, natural slopes shall be calculated using points identified as natural slopes of twenty percent (20%), thirty percent (30%), and forty percent (40%), and shall be located on the contour map and connected by a continuous line. That area bounded by said lines and intersecting property lines shall be used for determining project density. Small washes or outcrops, which have slopes distinctly different from surrounding property, and are not part of the contiguous topography, may be excluded from the slope determination.

10-13B-2: Development in Geologic Hazard Areas

A. *Geologic Hazard Areas (UGS 1 – 4: subsections A1 through A4 of this section):* For any development in the city with a geologic hazard listed below, applicant shall submit a report prepared by a qualified, licensed geologist specializing in engineering geology, or a licensed civil engineer, trained and experienced in the practice of geotechnical engineering. Development in the geologic hazard overlay for high category rockfall areas shall be reviewed by the hillside review board.

1. Surface fault rupture and earthquake: well-defined Holocene, and well-defined fault areas, red and purple lines/categories (extending five hundred feet (500') on the downthrown side and two hundred fifty feet (250') on the upthrown side of each red/purple fault line).
2. Liquefaction: Very High category.
3. Landslide: Very High category.
4. Rockfall: High category.

B. *General Requirements for Development in a Geologic Hazard Area:*

1. Submit a site-specific report prepared by a qualified, licensed geologist specializing in engineering geology, or a licensed civil engineer, trained and experienced in the practice of geotechnical engineering with the following minimum requirements:
    a. Identify all geologic hazard areas (UGS 1 – 4: subsections A1 through A4 of this section);
    b. Identify any other geologic hazards, not listed above (UGS 1 – 4: subsections A1 through A4 of this section), which present an unacceptable risk to development;
    c. Demonstrate which areas of the development are suitable for the proposed use;
    d. Recommend specific measures necessary to make the land suitable for the proposed use;

e. Recommend the optimal placement of all structures, roadways, utilities, trails and infrastructure in relation to the geologic hazard area;
f. Slope stability analysis: conclusions and recommendations concerning the effects of material removal, introduction of water, both on and off site, including, where applicable, on mesa tops, seismic activity, and erosion on slope stability;
g. Foundation investigation: conclusions and recommendations concerning the effects of soil conditions on foundation and structural stability, including bearing capacity, sheer strength, and shrink/swell potential of soils;
h. Spring location: the location and yield of springs and seeps which shall be shown on the site plan;
i. Structural features: structural features including any geological limitations;
j. Surface hazards: existence of surface hazards including potential for rockfalls and toppling failures to cliffs, slopes and overhangs above the subject property; and
k. Effect of geologic conditions: conclusions and recommendations regarding the effect of geologic conditions on the proposed development, together with recommendations identifying the means proposed to minimize any hazard to life or property, or adverse impact on the natural environment.

2. The city shall review the applicant's report. If the applicant's report is deemed adequate by the city engineer or designee, development may proceed if the report recommendations are followed. If the report is deemed incomplete or inadequate by the city engineer or designee, the development application shall be denied. If denied, the applicant may request an independent review, and the city engineer or designee may order a review by independent, qualified professionals. The professionals selected by the city shall review and prepare written findings and comments on the applicant's report. The cost of the independent, qualified professionals shall be paid to the city by applicant. Applicant may develop if the independent review and written findings and comments are implemented, in addition to any nonconflicting recommendations in the initial report of applicant. The city engineer or designee is the land use authority for the decision. The reports shall be specifically identified on the plat and available to all owners and interested parties.

3. All development shall be outside the geologic hazard areas in subsections A1 through A4 of this section, unless:
a. The city has accepted applicant's report, prepared by a qualified, licensed geologist specializing in engineering geology or a licensed professional engineer trained and practicing in the field of geotechnical engineering, and it recommends development, and shows hazards can be adequately mitigated for the proposed land use;
b. If the city has not accepted applicant's report, the applicant also adopts and implements the independent review and writing findings and comments, in addition to any nonconflicting recommendations in applicant's report;
c. All report recommendations, and HDOZ permit conditions (when required), are adopted by the city and are conditions of development.

4. Hold the city harmless from all claims resulting from any damage related to development within a geologic hazard area by executing a "geologic hazard disclaimer of liability and agreement" and by placing a "notice of hazard" on the final plat.

5. The applicant may appeal a decision in accordance with chapter 3 of this title.

C. *Compliance:* No structure or land shall be constructed, located, extended, converted or altered without full compliance with the terms of this chapter and other applicable regulations.

D. *Abrogation and Greater Restrictions:* This chapter is not intended to repeal, abrogate or impair any existing easement, covenant or deed restriction; however, where this chapter and another ordinance, easement, covenant or deed restriction conflict or overlap, the more stringent restriction shall prevail.

E. *Interpretation:* In the interpretation and application of this chapter, all provisions are minimum requirements in addition to applicable provisions of this title.

EXHIBITS PROVIDED

Exhibit A1 - Revised Exhibits for 12-18-2024 Hillside Meeting

Includes updated hillside map, comparison map of previously proposed site disturbance vs new proposed site disturbance boundary, updated grading plan, and updated cut fill heat map.

Exhibit A – Slope Analysis Map

Exhibit B – Cut Fill Heat Map

Exhibit C – Preliminary Drainage Study

Exhibit D – Grading Plan

Exhibit E – Site Plan

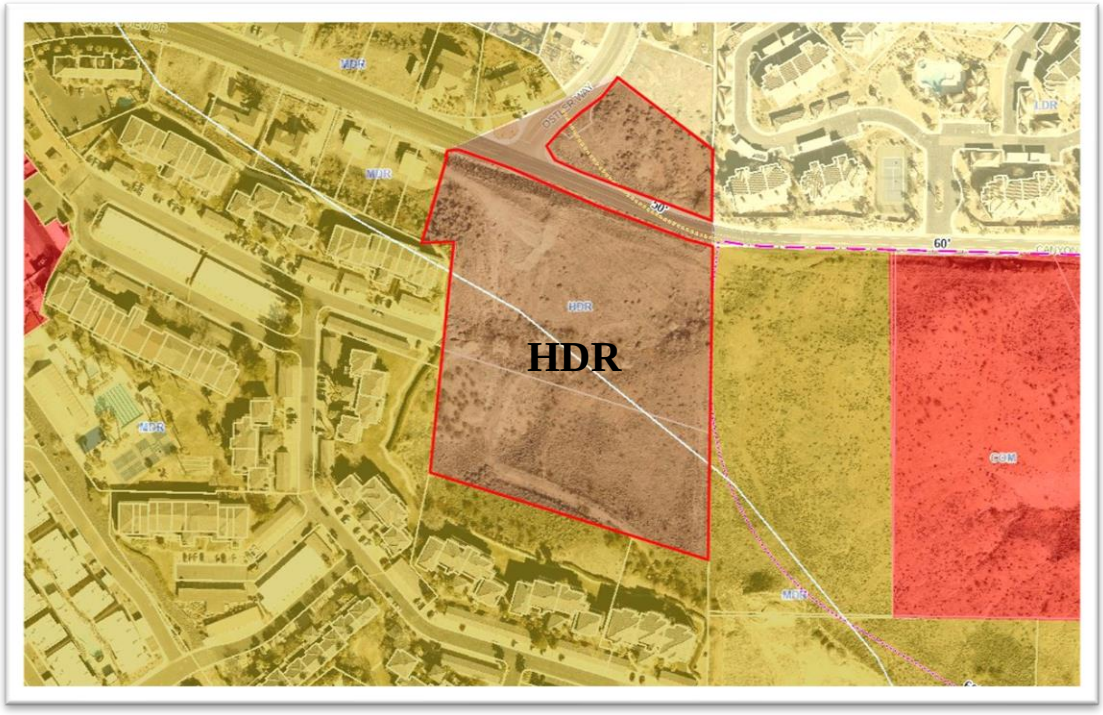
Exhibit F – Landscape Plan

Exhibit G – Geotechnical Investigation

RECOMMENDATION

Section 10-13A-8(B)(1) of the “Hillside Review Board Powers and Duties” states that the Hillside Board can make recommendations to “adopt, modify or reject a proposal” to the Planning Commission (PC).

General Plan – HDR– (High Density Residential)



Zoning –R-3 (Planned Development Residential)

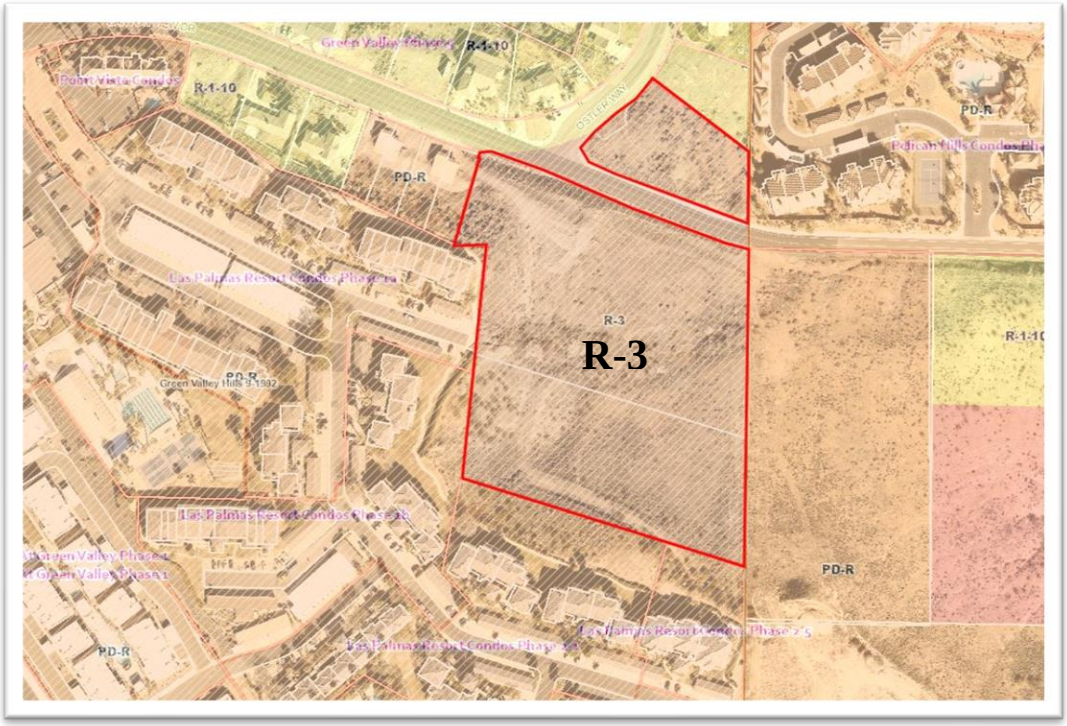
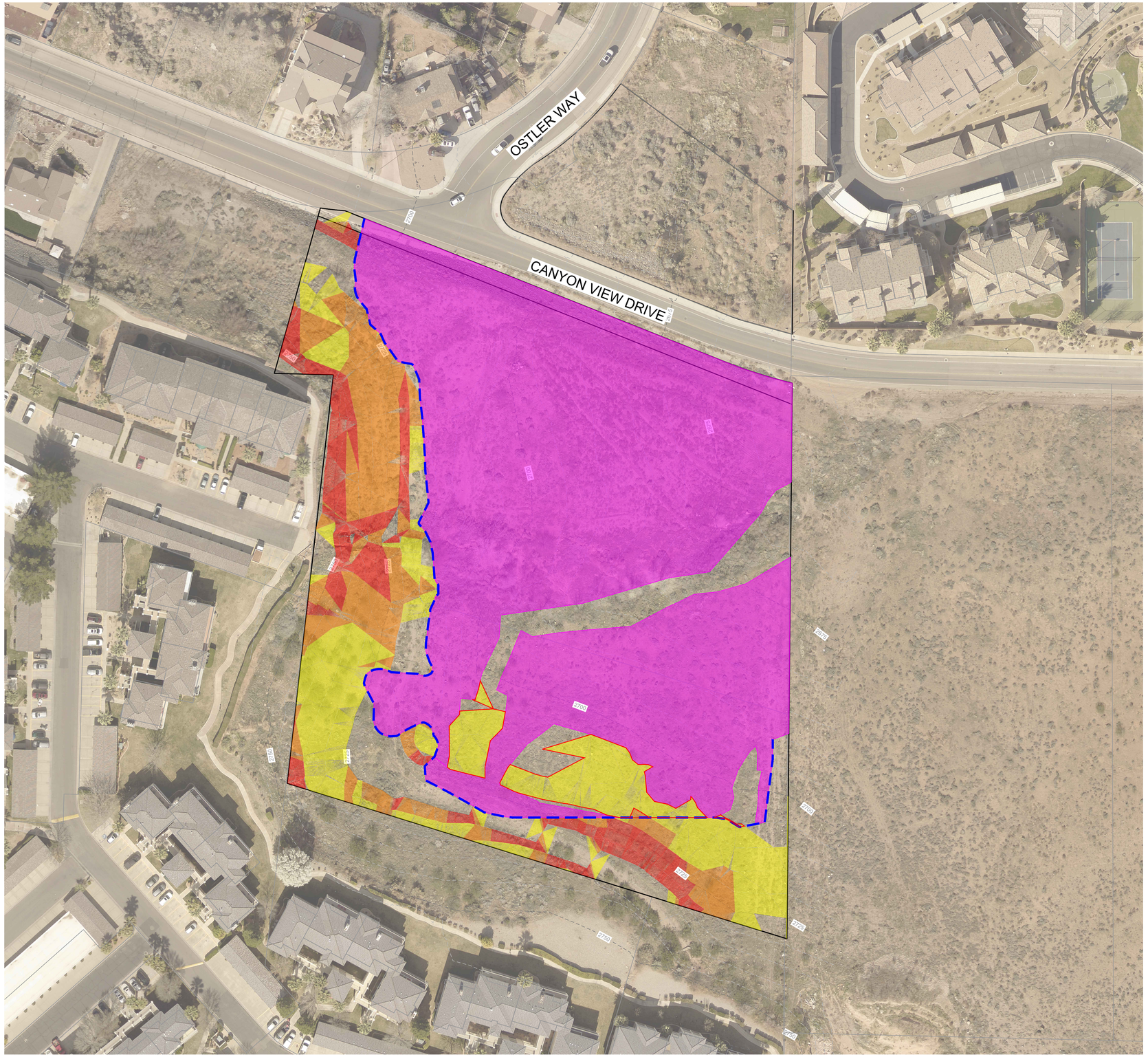


Exhibit A1
Revised Exhibits for 12-18-2024 Hillside Meeting



GRAPHIC SCALE

50 0 25 50 100

(IN FEET)
1 inch = 50 ft.

SURFACE SLOPE DATA						
NUMBER	MINIMUM SLOPE	MAXIMUM SLOPE	COLOR	TOTAL AREA, AC	PROPOSED DISTURBED, AC	PROPOSED DISTURBED, %
1	20%	30%		0.86	0.26	29.9
2	30%	40%		0.58	0.002	0.3
3	40%	99999900%		0.39	0.00	0.0

TOTAL AREA: 6.56 ACRES

INDICATES AREAS THAT HAVE BEEN PREVIOUSLY DISTURBED OR ARE NON-CONTIGUOUS SLOPES.

INDICATES AREAS WITHIN THE PROPOSED DISTURBED AREA WITH NATURAL SLOPES BETWEEN 20% AND 30%.

BOUNDARY OF PROPOSED SITE DISTURBANCE

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

BEN SHAKESPEARE
(435) 703-4164
37 W 1070 S STE 101
ST GEORGE, UTAH 84770

ENGINEERING CONTACT

BUSH AND GUDGELL, INC.
205 EAST TABERNACLE #4
ST GEORGE, UT 84770

RICK MEYER - PROJECT MANAGER
(435)-673-2337

No.	Date	By	Revision

BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
205 East Tabernacle Suite #4
St. George, Utah 84770
Phone (435) 673-2337 / Fax (435) 673-3161
www.bushandgudgell.com

DATE: DEC 2024
DRAWN: RM
APPROVED:
SCALE: NOTED
JOB NO.: 221018

HILLSIDE MAP
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 1 OF 4 SHEETS

FILE:

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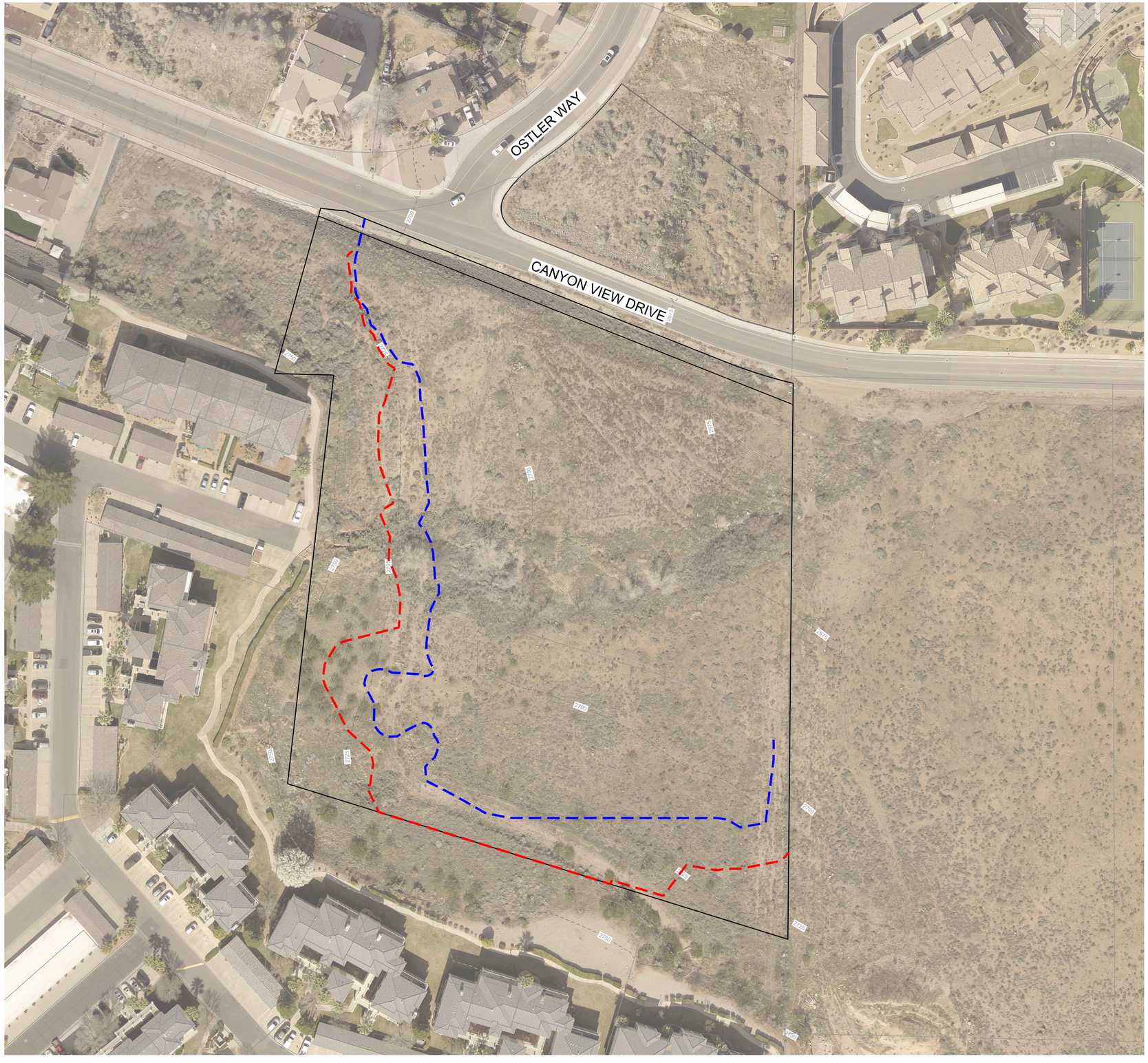

LEGEND

- BOUNDARY OF PREVIOUSLY PROPOSED SITE DISTURBANCE
- BOUNDARY OF PROPOSED SITE DISTURBANCE

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

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DISTURBANCE AREAS
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 2 OF 4 SHEETS

FILE:

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GRADING NOTES

APPROXIMATELY **16,290** CU.YD. OF CUT, **35,205** CU.YD. OF FILL AND **18,915** CU.YD. OF **IMPORT** MATERIAL IS REQUIRED (FOR GRADING PERMIT ONLY). THE CONTRACTOR SHOULD VERIFY THE QUANTITIES FOR COMPLETION OF WORK. QUANTITIES ARE BASED ON FINISH GRADE OF ROADS & PADS.

ALL IMPORTED STRUCTURAL FILL SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO DELIVERY TO THE SITE. ALL IMPORTED STRUCTURAL FILL SHALL BE PLACED IN 8-INCH LOOSE HORIZONTAL LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF MAXIMUM DRY DENSITY (ASTM D-1557).

ALL EXCAVATION, GRADING AND FILL OPERATIONS WITHIN THE BUILDING AREA SHOULD BE OBSERVED BY THE GEOTECHNICAL ENGINEER TO VERIFY SUB-SOIL CONDITIONS AND DETERMINE ADEQUACY OF SITE PREPARATION, SUITABILITY OF FILL MATERIALS AND COMPLIANCE WITH COMPACTION REQUIREMENTS.

THE CONTRACTOR SHALL PROVIDE SUITABLE EQUIPMENT TO CONTROL DUST AND AIR POLLUTION CAUSED BY CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL ALSO PROVIDE SUITABLE MUD AND DIRT CONTAINMENT TO MAINTAIN THE WORK SITE, ACCESS ROADWAYS AND ADJACENT PROPERTIES IN A CLEAN CONDITION.

ALL EXCAVATION AND GRADING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF ST.GEORGE CITY AND APPENDIX J OF THE INTERNATIONAL BUILDING CODE, 2018 EDITION, AND THE SPECIFICATIONS AND REQUIREMENTS INCLUDED IN THE GEOTECHNICAL STUDY.

GEOTECHNICAL ENGINEER TO PROVIDE GRADING COMPLETION REPORT TO CONFIRM WORK HAS BEEN PERFORMED IN CONFORMANCE WITH THEIR RECOMMENDATIONS.

OWNER IS RESPONSIBLE FOR ALL ON-SITE DRAINAGE AND DETENTION.

LEGEND

- EXISTING GROUND CONTOUR
- FINISH GROUND CONTOUR
- LOT LINE
- RETAINING WALL
- LANDSCAPE DRAINAGE SWALE
- PAD: 00.00 — PAD ELEVATION IN FEET
- TW: 00.00 — TOP OF WALL ELEVATION IN FEET
- BW: 00.00 — BOTTOM OF EXPOSED WALL ELEVATION IN FEET
- FL: 00.00 — FL = FLOW LINE
- TC: 00.00 — TC = TOP OF CONCRETE
- TBC: 00.00 — TBC = TOP BACK OF CURB
- SLOPE IN RUN:RISE
- 2650 — CONTOUR ELEVATION IN FEET

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)

1 inch = 50 ft.

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

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GRADING PLAN
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 3 OF 4 SHEETS

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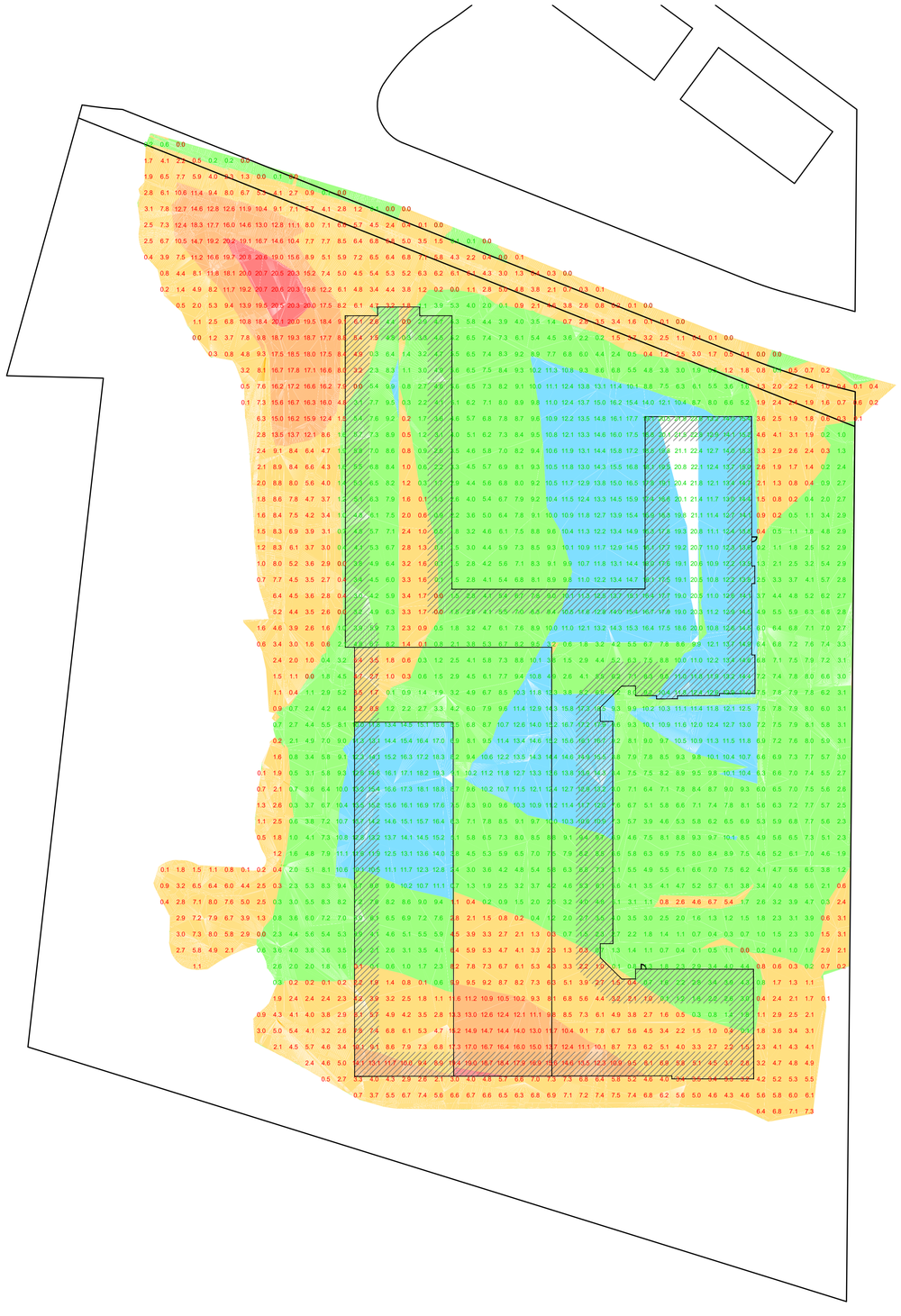

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.

Elevations Table				
Number	Minimum Elevation	Maximum Elevation	Area	Color
1	-40.00	-30.00	92.87	
2	-30.00	-20.00	6027.93	
3	-20.00	-10.00	58935.32	
4	-10.00	0.00	122794.60	
5	0.00	10.00	54366.29	
6	10.00	20.00	1433.88	

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CUT FILL HEAT MAP
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 4 OF 4 SHEETS

FILE:

Exhibit A
Slope Analysis Map

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)
1 inch = 50 ft.

SURFACE SLOPE DATA				
NUMBER	MINIMUM SLOPE	MAXIMUM SLOPE	COLOR	AREA, AC
1	20.000%	29.999%		1.20
2	30.000%	39.999%		0.64
3	40.000%	7944.292%		0.32

TOTAL AREA: 7.51 ACRES
DEVELOPABLE AREA: 5.74 ACRES

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

BEN SHAKESPEARE
(435) 703-4164
37 W 1070 S STE 101
ST GEORGE, UTAH 84770

ENGINEERING CONTACT

BUSH AND GUDGELL, INC.
205 EAST TABERNACLE #4
ST GEORGE, UT 84770

RICK MEYER - PROJECT MANAGER
(435)-673-2337

Preliminary.
For Review Only.
Not For
Construction.

No.	Date	By	Revision

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HILLSIDE MAP
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 1 OF 2 SHEETS
FILE:

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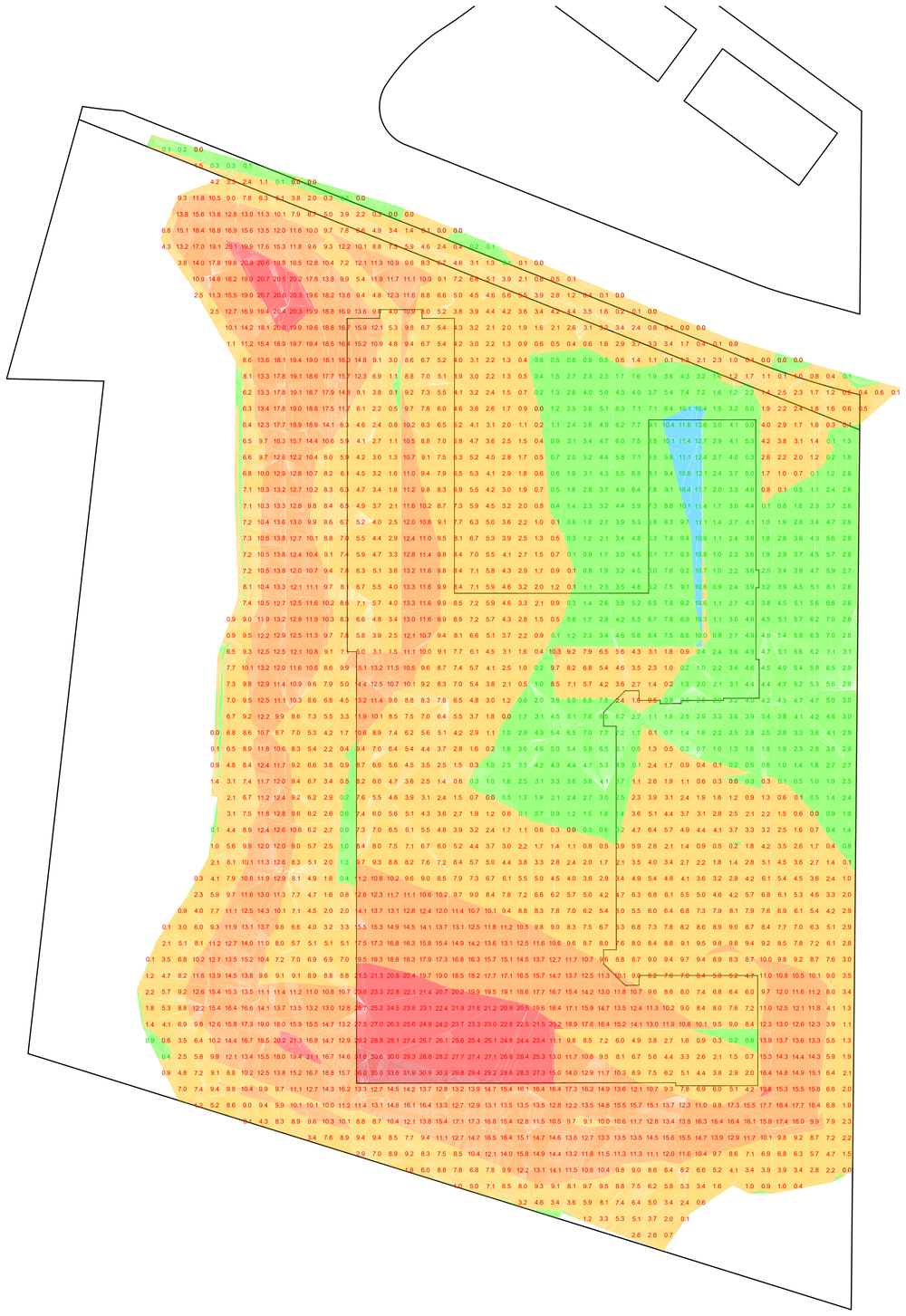
Exhibit B
Cut Fill Heat Map



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.

Elevations Table				
Number	Minimum Elevation	Maximum Elevation	Area	Color
1	-40.00	-30.00	960.11	
2	-30.00	-20.00	7872.09	
3	-20.00	-10.00	57106.30	
4	-10.00	0.00	114449.82	
5	0.00	10.00	48668.92	
6	10.00	20.00	1550.60	

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CUT FILL HEAT MAP
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 1 OF 1 SHEETS
FILE:

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Exhibit C
Preliminary Drainage Study

PRELIMINARY DRAINAGE STUDY
FOR

Canyon View Apartments

A Residential Development located in

St George, Utah

PREPARED BY: Bush & Gudgell Engineering

205 East Tabernacle Suite #4
St. George City, Utah 84770
Phone: (435) 673-2337
Fax: (435) 673-3161
www.bushandgudgell.com

PROFESSIONAL ENGINEER
No.5567007
WILLIAM F. MEYER, JR.
01/31/2024
STATE OF UTAH

Project Engineer	Rick Meyer, P.E.
Date	January 31, 2024
Job Number	B&G #221249

I. INTRODUCTION

The subject property is located in St George, Utah. Access to the property is granted from Canyon View Drive. The project site is located south of the intersection with Ostler Way. It is on parcels SG-6-2-35-433 and SG-6-2-35-3009.

The project is located within the northwest quarter of Section 35, Township 42 South, Range 16 West, Salt Lake Base and Meridian. The land is currently zoned R-3.

The purpose of the project is to grade and develop approximately 5.45 acres of the 6.56 acres of the parcels. See site plan in appendix. There is approximately 9.28 acres of offsite land that releases stormwater onto the property. The purpose of this study is to determine the magnitude of expected runoff and how to handle the water to avoid flooding or property damage.

In summary, the expected runoff through the site during the 100-year storm event is 15.56 cfs. There are several locations where this water will be released. Ultimately it will end up in Canyon View Drive after being detained. The detention system will be underground on the site. This will help prevent flooding downstream of the project.

In addition to the detention system, drainage swales will be constructed throughout the site to direct runoff where it needs to go. Dimensions of these swales vary by location. A map in the appendix shows the locations and dimensions of the swales.

II. METHODOLOGY

Software

Autodesk Storm and Sanitary Analysis (SSA) software was used to calculate runoff rates and volumes for the site. SSA uses the TR-55 method to calculate stormwater runoff. TR-55 uses rainfall rate, curve number, time of concentration, and area as inputs.

Model Setup

The rainfall rates were taken from the *City of St George Drainage Manual*. The 3-hour Farmer-Fletcher and 24-hour SCS Type II rainfall distributions were used for the three design storms used. The table below shows the rainfall intensities used in the model.

Design Rainfall Depths, inches	
10-year 3-hour	1.00
100-year 3-hour	1.64
100-year 24-hour	2.51

Bush and Gudgell
205 East Tabernacle #4
St. George, UT 84770
www.bushandgudgell.com
Ph. 435-673-2337
Fax 435-673-3161

Curve number for the site is taken from a land use table that includes hydrologic soil group as a variable. A web soil survey was conducted to estimate the hydrologic soil group. The entire site is soil group D.

Terrain slopes and Manning's roughness was used in SSA to calculate time of concentration.

III. RESULTS

The SSA model was run three times for the three rainfall rates (see above). Results can be seen in the table below. These are total post-development runoff rates before detention.

SSA Model Results		
Storm I.D.	Peak Flow, cfs	Total Runoff, cu ft
10-year 3-hour	5.81	22,122
100-year 3-hour	15.56	49,709
100-year 24-hour	20.46	92,142

Detention for the site will be calculated at a later time.

IV. CONCLUSION

Contributing area of this site is approximately 16 acres, including 9 acres from offsite and 7 acres onsite. This area has a potential for stormwater runoff, which will cause flooding and/or erosion if not properly handled. Three design storms were analyzed and drainage swales were designed to safely convey water through the site. The final site design will include underground detention east and west of the proposed building.

Bush and Gudgell
205 East Tabernacle #4
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Ph. 435-673-2337
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IV. APPENDICES

A. Site Plan

B. SSA Model Schematic

C. SSA Model Hydrographs and Reports

D. Drainage Channel Calculations and Details

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Appendix A - Site Plan

Bush and Gudgell
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GRADING NOTES

APPROXIMATELY 57,511 CU.YD. OF CUT, 6,246 CU.YD. OF FILL AND 51,265 CU.YD. OF **EXPORT** MATERIAL IS REQUIRED (FOR GRADING PERMIT ONLY). THE CONTRACTOR SHOULD VERIFY THE QUANTITIES FOR COMPLETION OF WORK. QUANTITIES ARE BASED ON FINISH GRADE OF ROADS & PADS.

ALL IMPORTED STRUCTURAL FILL SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO DELIVERY TO THE SITE. ALL IMPORTED STRUCTURAL FILL SHALL BE PLACED IN 8-INCH LOOSE HORIZONTAL LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF MAXIMUM DRY DENSITY (ASTM D-1557).

ALL EXCAVATION, GRADING AND FILL OPERATIONS WITHIN THE BUILDING AREA SHOULD BE OBSERVED BY THE GEOTECHNICAL ENGINEER TO VERIFY SUB-SOIL CONDITIONS AND DETERMINE ADEQUACY OF SITE PREPARATION, SUITABILITY OF FILL MATERIALS AND COMPLIANCE WITH COMPACTION REQUIREMENTS.

THE CONTRACTOR SHALL PROVIDE SUITABLE EQUIPMENT TO CONTROL DUST AND AIR POLLUTION CAUSED BY CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL ALSO PROVIDE SUITABLE MUD AND DIRT CONTAINMENT TO MAINTAIN THE WORK SITE, ACCESS ROADWAYS AND ADJACENT PROPERTIES IN A CLEAN CONDITION.

ALL EXCAVATION AND GRADING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF ST.GEORGE CITY AND APPENDIX J OF THE INTERNATIONAL BUILDING CODE, 2018 EDITION, AND THE SPECIFICATIONS AND REQUIREMENTS INCLUDED IN THE GEOTECHNICAL STUDY.

GEOTECHNICAL ENGINEER TO PROVIDE GRADING COMPLETION REPORT TO CONFIRM WORK HAS BEEN PERFORMED IN CONFORMANCE WITH THEIR RECOMMENDATIONS.

OWNER IS RESPONSIBLE FOR ALL ON-SITE DRAINAGE AND DETENTION.

LEGEND

- EXISTING GROUND CONTOUR
- FINISH GROUND CONTOUR
- LOT LINE
- RETAINING WALL
- LANDSCAPE DRAINAGE SWALE
- PAD: 00.00 — PAD ELEVATION IN FEET
- TW: 00.00 — TOP OF WALL ELEVATION IN FEET
- BW: 00.00 — BOTTOM OF EXPOSED WALL ELEVATION IN FEET
- FL: 00.00 — FL = FLOW LINE
- TC: 00.00 — TC = TOP OF CONCRETE
- TBC: 00.00 — TBC = TOP BACK OF CURB
- SLOPE IN RUN:RISE
- 2650 — CONTOUR ELEVATION IN FEET

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)
1 inch = 50 ft.

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

BEN SHAKESPEARE
(435) 703-4164
37 W 1070 S STE 101
ST GEORGE UTAH 84770

ENGINEERING CONTACT

BUSH AND GUDGELL, INC.
205 EAST TABERNACLE #4
ST GEORGE, UT 84770

RICK MEYER - PROJECT MANAGER
(435)-673-2337

PROFESSIONAL ENGINEER
No.5567007
WILLIAM F. MEYER, JR.
01/31/2024
STATE OF UTAH

No	Date	By	Revision

BUSH & GUDGELL, INC.
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205 East Tabernacle Suite #4
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www.bushandgudgell.com

DATE: JAN 2024
DRAWN: RM
APPROVED:
SCALE: NOTED
JOB NO. 221018

GRADING PLAN
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 2 OF 3 SHEETS
FILE:

X:\221000-221999\221018 - Canyon View Apartments\Drawings\Exhibits\SLOPE ANALYSIS.dwg

Appendix B – SSA Model Schematic

Bush and Gudgell
205 East Tabernacle #4
St. George, UT 84770

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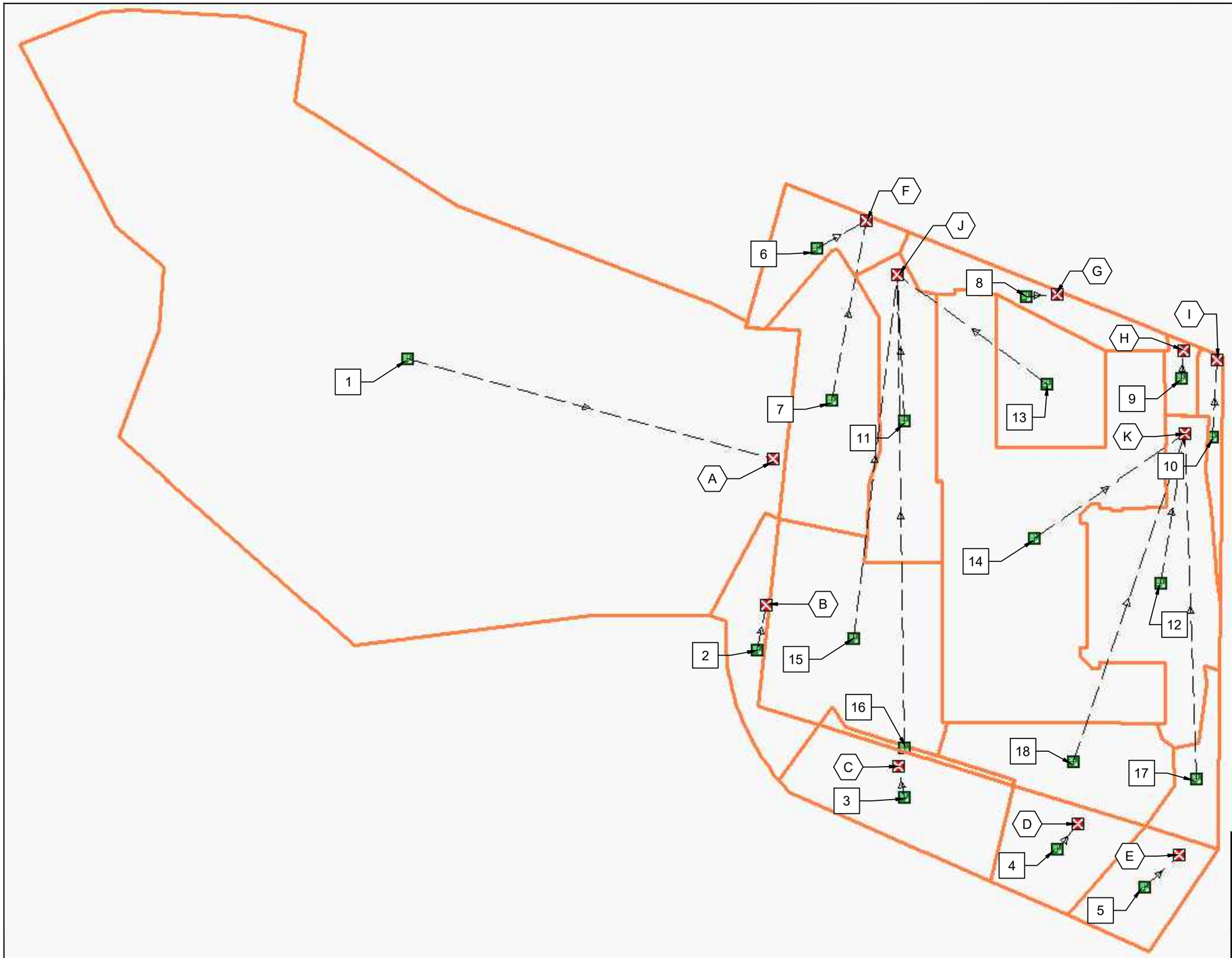

BASIN NAMES

1	BAS_OFF_LAS_PALMAS
2	BAS_OFF_01
3	BAS_OFF_02
4	BAS_OFF_03
5	BAS_OFF_04
6	BAS_BP_01
7	BAS_BP_02
8	BAS_BP_03
9	BAS_BP_04
10	BAS_BP_05
11	BAS_DRIVE_WEST
12	BAS_DRIVE_EAST
13	BAS_POOL
14	BAS_BLDG
15	BAS_LS_W_01
16	BAS_LS_W_02
17	BAS_LS_E_01
18	BAS_LS_E_02

OUTFALL NAMES

A	OUT_OFF_LAS_PALMAS
B	OUT_OFF_01
C	OUT_OFF_02
D	OUT_OFF_03
E	OUT_OFF_04
F	OUT_BP_1-2
G	OUT_BP_03
H	OUT_BP_04
I	OUT_BP_05
J	OUT_DRIVE_WEST
K	OUT_DRIVE_EAST

SSA MODEL SCHEMATIC

CANYON VIEW APARTMENTS
ST GEORGE, UTAH

BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
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St. George, Utah 84770
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Appendix C – SSA Model Hydrographs and Reports

Bush and Gudgell
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Subbasin Hydrology

Subbasin : BAS_BLDG

Input Data

Area (ac) 1.80
Peak Rate Factor 0.00
Weighted Curve Number 98.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.80	D	98.00
Composite Area & Weighted CN	1.80		98.00

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	150	0.00	0.00
Slope (%) :	.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	50.66	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.01	0.00	0.00
Flow Length (ft) :	400	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	2	0.00	0.00
Velocity (ft/sec) :	6.64	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Total TOC (min) 51.66

Subbasin Runoff Results

Total Rainfall (in)	1.64
Total Runoff (in)	1.42
Peak Runoff (cfs)	2.56
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:51:40

Subbasin : BAS_BP_01

Input Data

Area (ac) 0.28
Peak Rate Factor 0.00
Weighted Curve Number 89.34
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.04	D	98.00
Natural western desert	0.24	D	88.00
Composite Area & Weighted CN	0.28		89.34

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.13	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	125	0.00	0.00
Slope (%) :	30	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.84	0.00	0.00
Computed Flow Time (min) :	0.24	0.00	0.00

Total TOC (min) 6.64

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.76
Peak Runoff (cfs) 0.41
Weighted Curve Number 89.34
Time of Concentration (days hh:mm:ss) 0 00:06:38

Subbasin : BAS_BP_02

Input Data

Area (ac) 0.62
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.62	D	88.00
Composite Area & Weighted CN	0.62		88.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	11.14	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.055	0.00	0.00
Flow Length (ft) :	320	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	0.66	0.00	0.00
Computed Flow Time (min) :	8.14	0.00	0.00

Total TOC (min) 19.28

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.67
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:19:17

Subbasin : BAS_BP_03

Input Data

Area (ac) 0.26
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.26	D	88.00
Composite Area & Weighted CN	0.26		88.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.13	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.015	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Channel Slope (%) :	8	0.00	0.00
Cross Section Area (ft²) :	.5	0.00	0.00
Wetted Perimeter (ft) :	2	0.00	0.00
Velocity (ft/sec) :	11.15	0.00	0.00
Computed Flow Time (min) :	0.45	0.00	0.00

Total TOC (min) 6.85

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.35
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:06:51

Subbasin : BAS_BP_04

Input Data

Area (ac) 0.07
Peak Rate Factor 0.00
Weighted Curve Number 98.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.07	D	98.00
Composite Area & Weighted CN	0.07		98.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.02	0.00	0.00
Flow Length (ft) :	80	0.00	0.00
Slope (%) :	10	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.91	0.00	0.00
Computed Flow Time (min) :	1.47	0.00	0.00

Total TOC (min) 1.47

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 1.42
Peak Runoff (cfs) 0.23
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:01:28

Subbasin : BAS_BP_05

Input Data

Area (ac) 0.09
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.09	D	88.00
Composite Area & Weighted CN	0.09		88.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	30	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	5.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	3.61	0.00	0.00
Computed Flow Time (min) :	0.92	0.00	0.00

Total TOC (min) 5.92

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.13
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:05:55

Subbasin : BAS_DRIVE_E

Input Data

Area (ac) 0.77
Peak Rate Factor 0.00
Weighted Curve Number 91.60
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.50	D	98.00
> 75% grass cover, Good	0.27	D	80.00
Composite Area & Weighted CN	0.77		91.60

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	40	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.11	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.015	0.00	0.00
Flow Length (ft) :	335	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	4.80	0.00	0.00
Computed Flow Time (min) :	1.16	0.00	0.00

Total TOC (min) 11.27

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.89
Peak Runoff (cfs) 1.36
Weighted Curve Number 91.60
Time of Concentration (days hh:mm:ss) 0 00:11:16

Subbasin : BAS_DRIVE_WEST

Input Data

Area (ac) 0.52
Peak Rate Factor 0.00
Weighted Curve Number 89.16
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.26	D	98.00
> 75% grass cover, Good	0.26	D	80.00
Composite Area & Weighted CN	0.52		89.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	12.08	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.015	0.00	0.00
Flow Length (ft) :	325	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	3.40	0.00	0.00
Computed Flow Time (min) :	1.59	0.00	0.00

Total TOC (min) 13.68

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.75
Peak Runoff (cfs) 0.70
Weighted Curve Number 89.16
Time of Concentration (days hh:mm:ss) 0 00:13:41

Subbasin : BAS_LS_E_01

Input Data

Area (ac) 0.18
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.18	D	88.00
Composite Area & Weighted CN	0.18		88.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	11.14	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.055	0.00	0.00
Flow Length (ft) :	125	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	0.93	0.00	0.00
Computed Flow Time (min) :	2.25	0.00	0.00

Total TOC (min) 13.39

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.21
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:13:23

Subbasin : BAS_LS_E_02

Input Data

Area (ac) 0.46
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.46	D	88.00
Composite Area & Weighted CN	0.46		88.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	30	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	4.25	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.055	0.00	0.00
Flow Length (ft) :	235	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	0.93	0.00	0.00
Computed Flow Time (min) :	4.23	0.00	0.00

Total TOC (min) 8.48

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.61
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:08:29

Subbasin : BAS_LS_W_01

Input Data

Area (ac) 0.92
Peak Rate Factor 0.00
Weighted Curve Number 80.43
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.02	D	98.00
> 75% grass cover, Good	0.89	D	80.00
Composite Area & Weighted CN	0.91		80.43

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	30	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.12	0.00	0.00
Computed Flow Time (min) :	4.25	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.055	0.00	0.00
Flow Length (ft) :	207	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	0.93	0.00	0.00
Computed Flow Time (min) :	3.72	0.00	0.00

Total TOC (min) 7.98

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.37
Peak Runoff (cfs) 0.59
Weighted Curve Number 80.43
Time of Concentration (days hh:mm:ss) 0 00:07:59

Subbasin : BAS_LS_W_02

Input Data

Area (ac) 0.04
Peak Rate Factor 0.00
Weighted Curve Number 88.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Natural western desert	0.04	D	88.00
Composite Area & Weighted CN	0.04		88.00

Time of Concentration

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.055	0.00	0.00
Flow Length (ft) :	215	0.00	0.00
Channel Slope (%) :	.5	0.00	0.00
Cross Section Area (ft²) :	1	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	0.66	0.00	0.00
Computed Flow Time (min) :	5.47	0.00	0.00

Total TOC (min) 5.47

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.68
Peak Runoff (cfs) 0.05
Weighted Curve Number 88.00
Time of Concentration (days hh:mm:ss) 0 00:05:28

Subbasin : BAS_OFF_01

Input Data

Area (ac) 0.28
Peak Rate Factor 0.00
Weighted Curve Number 80.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.28	D	80.00
Composite Area & Weighted CN	0.28		80.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	18.90	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	20	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	0.15	0.00	0.00

Total TOC (min) 19.05

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.36
Peak Runoff (cfs) 0.14
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:19:03

Subbasin : BAS_OFF_02

Input Data

Area (ac) 0.52
Peak Rate Factor 0.00
Weighted Curve Number 80.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.52	D	80.00
Composite Area & Weighted CN	0.52		80.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	15	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	8.44	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	15	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.25	0.00	0.00
Computed Flow Time (min) :	0.13	0.00	0.00

Total TOC (min) 8.58

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.36
Peak Runoff (cfs) 0.32
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:08:35

Subbasin : BAS_OFF_03

Input Data

Area (ac) 0.32
Peak Rate Factor 0.00
Weighted Curve Number 80.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.32	D	80.00
Composite Area & Weighted CN	0.32		80.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	15	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	8.44	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	70	0.00	0.00
Slope (%) :	15	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.25	0.00	0.00
Computed Flow Time (min) :	0.19	0.00	0.00

Total TOC (min) 8.63

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.36
Peak Runoff (cfs) 0.20
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:08:38

Subbasin : BAS_OFF_04

Input Data

Area (ac) 0.27
Peak Rate Factor 0.00
Weighted Curve Number 80.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.27	D	80.00
Composite Area & Weighted CN	0.27		80.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	50	0.00	0.00
Slope (%) :	15	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	8.44	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	80	0.00	0.00
Slope (%) :	15	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.25	0.00	0.00
Computed Flow Time (min) :	0.21	0.00	0.00

Total TOC (min) 8.66

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.36
Peak Runoff (cfs) 0.17
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:08:40

Subbasin : BAS_OFF_LAS_PALMAS

Input Data

Area (ac) 7.89
Peak Rate Factor 0.00
Weighted Curve Number 92.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/8 acre lots, 65% impervious	7.89	D	92.00
Composite Area & Weighted CN	7.89		92.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.35	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	32.92	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	800	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	4.65	0.00	0.00

Total TOC (min) 37.56

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 0.92
Peak Runoff (cfs) 8.50
Weighted Curve Number 92.00
Time of Concentration (days hh:mm:ss) 0 00:37:34

Subbasin : BAS_POOL

Input Data

Area (ac) 0.38
Peak Rate Factor 0.00
Weighted Curve Number 98.00
Rain Gage ID ..... STGEORGE

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.38	D	98.00
Composite Area & Weighted CN	0.38		98.00

Time of Concentration

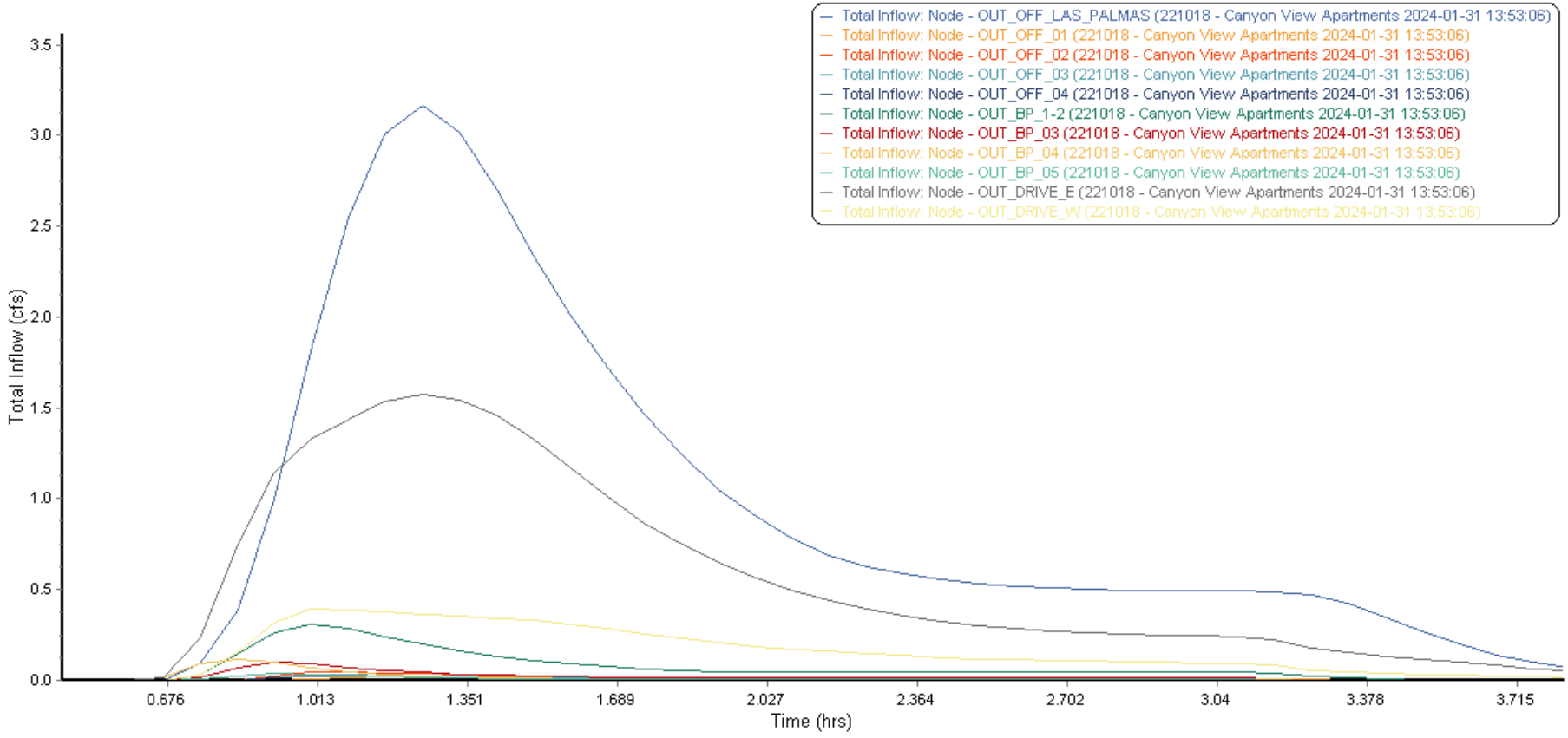
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.2	0.00	0.00
Flow Length (ft) :	215	0.00	0.00
Slope (%) :	.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	1.1	0.00	0.00
Velocity (ft/sec) :	0.05	0.00	0.00
Computed Flow Time (min) :	67.57	0.00	0.00

Total TOC (min) 67.57

Subbasin Runoff Results

Total Rainfall (in) 1.64
Total Runoff (in) 1.42
Peak Runoff (cfs) 0.44
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 01:07:34

10-year 3-hour, Farmer Fletcher
HYDROGRAPHS



Total Inflow Summary Table

Time period
From: 08/28/2018, 12:00:00 AM
To: 09/01/2018, 12:00:00 AM

Thresholds
Exceedance: 0
Deficit: 0

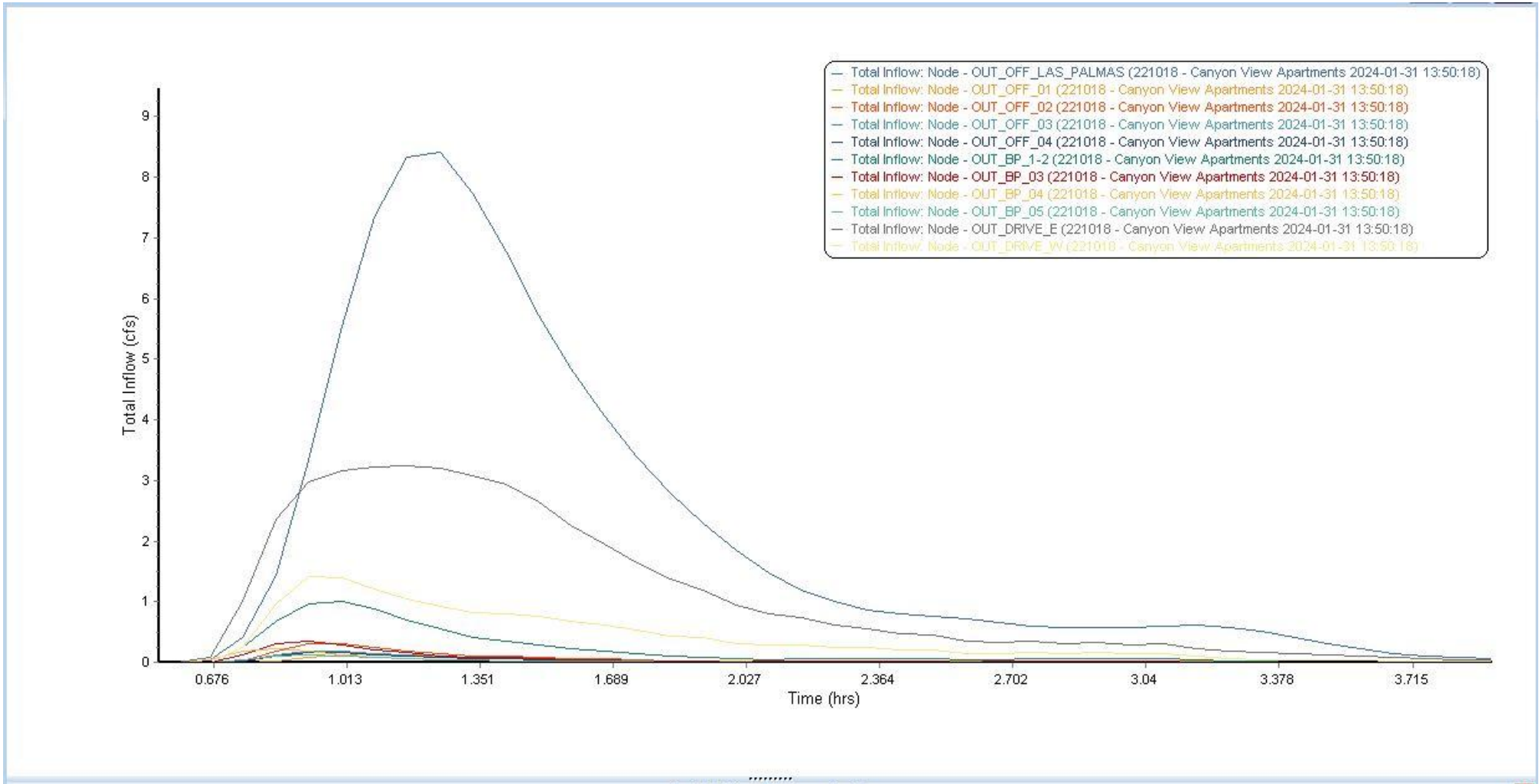
Detention storage
Max flow: 0

Element ID	OUT_OFF_LAS_PALMAS	OUT_OFF_01	OUT_OFF_02	OUT_OFF_03	OUT_OFF_04	OUT_BP_1-2	OUT_BP_03	OUT_BP_04	OUT_BP_05	OUT_DRIVE_E	OUT_DRIVE_W
Maximum Total Inflow (cfs)	3.17	0.02	0.04	0.03	0.02	0.31	0.10	0.12	0.04	1.57	0.39
Minimum Total Inflow (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Event Mean Total Inflow (cfs)	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01
Duration of Exceedances (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duration of Deficits (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Exceedances	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Deficits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Exceedance (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Deficit (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Inflow Volume (ft³)	11524.57	82.68	156.08	96.52	80.81	871.06	239.71	202.26	88.11	6818.33	1962.05
Detention Storage (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BAS_BLDG	1.80	0.00	98.00	1.00	0.79	1.42	1.31	0 00:51:39
2	BAS_BP_01	0.28	0.00	89.34	1.00	0.30	0.08	0.13	0 00:10:00
3	BAS_BP_02	0.62	0.00	88.00	1.00	0.25	0.16	0.20	0 00:19:16
4	BAS_BP_03	0.26	0.00	88.00	1.00	0.25	0.07	0.10	0 00:10:00
5	BAS_BP_04	0.07	0.00	98.00	1.00	0.79	0.05	0.12	0 00:10:00
6	BAS_BP_05	0.09	0.00	88.00	1.00	0.25	0.02	0.04	0 00:10:00
7	BAS_DRIVE_E	0.77	0.00	91.60	1.00	0.39	0.30	0.49	0 00:11:16
8	BAS_DRIVE_WEST	0.52	0.00	89.16	1.00	0.29	0.15	0.22	0 00:13:40
9	BAS_LS_E_01	0.18	0.00	88.00	1.00	0.25	0.04	0.06	0 00:13:23
10	BAS_LS_E_02	0.46	0.00	88.00	1.00	0.25	0.12	0.18	0 00:10:00
11	BAS_LS_W_01	0.92	0.00	80.43	1.00	0.09	0.08	0.09	0 00:10:00
12	BAS_LS_W_02	0.04	0.00	88.00	1.00	0.25	0.01	0.02	0 00:10:00
13	BAS_OFF_01	0.28	0.00	80.00	1.00	0.08	0.02	0.02	0 00:19:03
14	BAS_OFF_02	0.52	0.00	80.00	1.00	0.08	0.04	0.05	0 00:10:00
15	BAS_OFF_03	0.32	0.00	80.00	1.00	0.08	0.03	0.03	0 00:10:00
16	BAS_OFF_04	0.27	0.00	80.00	1.00	0.08	0.02	0.02	0 00:10:00
17	BAS_OFF_LAS_PALMAS	7.89	0.00	92.00	1.00	0.40	3.18	3.17	0 00:37:33
18	BAS_POOL	0.38	0.00	98.00	1.00	0.79	0.30	0.23	0 01:07:34

100-year 3-hour, Farmer Fletcher
HYDROGRAPHS



Total Inflow Summary Table

Time period
From: 08/28/2018, 12:00:00 AM
To: 09/01/2018, 12:00:00 AM

Thresholds
Exceedance: 0
Deficit: 0

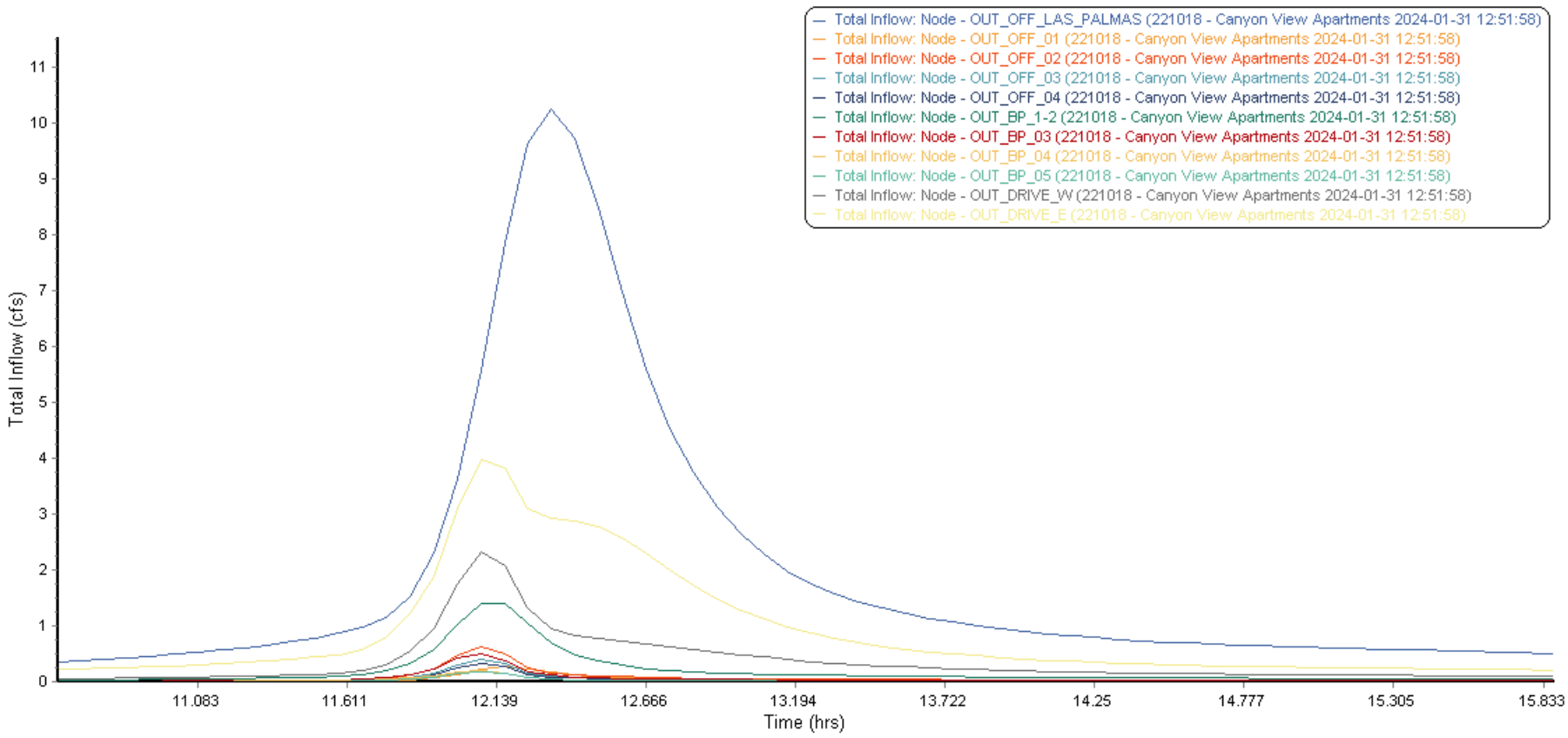
Detention storage
Max flow: 0

Element ID	OUT_OFF_LAS_PALMAS	OUT_OFF_01	OUT_OFF_02	OUT_OFF_03	OUT_OFF_04	OUT_BP_1-2	OUT_BP_03	OUT_BP_04	OUT_BP_05	OUT_DRIVE_E	OUT_DRIVE_W
Maximum Total Inflow (cfs)	8.41	0.14	0.31	0.19	0.16	1.00	0.34	0.23	0.13	3.24	1.41
Minimum Total Inflow (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Event Mean Total Inflow (cfs)	0.08	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.04	0.01
Duration of Exceedances (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duration of Deficits (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Exceedances	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Deficits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Exceedance (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Deficit (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Inflow Volume (ft³)	26363.04	356.01	669.95	414.3	348.1	2313.03	652.01	361.19	238.29	13324.82	4668.16
Detention Storage (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BAS_BLDG	1.80	0.00	98.00	1.64	1.42	2.55	2.56	0 00:51:39
2	BAS_BP_01	0.28	0.00	89.34	1.64	0.76	0.21	0.41	0 00:10:00
3	BAS_BP_02	0.62	0.00	88.00	1.64	0.68	0.43	0.67	0 00:19:16
4	BAS_BP_03	0.26	0.00	88.00	1.64	0.68	0.18	0.35	0 00:10:00
5	BAS_BP_04	0.07	0.00	98.00	1.64	1.42	0.10	0.23	0 00:10:00
6	BAS_BP_05	0.09	0.00	88.00	1.64	0.68	0.06	0.13	0 00:10:00
7	BAS_DRIVE_E	0.77	0.00	91.60	1.64	0.89	0.69	1.36	0 00:11:16
8	BAS_DRIVE_WEST	0.52	0.00	89.16	1.64	0.75	0.39	0.70	0 00:13:40
9	BAS_LS_E_01	0.18	0.00	88.00	1.64	0.68	0.12	0.21	0 00:13:23
10	BAS_LS_E_02	0.46	0.00	88.00	1.64	0.68	0.31	0.61	0 00:10:00
11	BAS_LS_W_01	0.92	0.00	80.43	1.64	0.37	0.34	0.59	0 00:10:00
12	BAS_LS_W_02	0.04	0.00	88.00	1.64	0.68	0.02	0.05	0 00:10:00
13	BAS_OFF_01	0.28	0.00	80.00	1.64	0.36	0.10	0.14	0 00:19:03
14	BAS_OFF_02	0.52	0.00	80.00	1.64	0.36	0.19	0.32	0 00:10:00
15	BAS_OFF_03	0.32	0.00	80.00	1.64	0.36	0.12	0.20	0 00:10:00
16	BAS_OFF_04	0.27	0.00	80.00	1.64	0.36	0.10	0.17	0 00:10:00
17	BAS_OFF_LAS_PALMAS	7.89	0.00	92.00	1.64	0.92	7.26	8.50	0 00:37:33
18	BAS_POOL	0.38	0.00	98.00	1.64	1.42	0.54	0.44	0 01:07:34

100-year 24-hour, SCS TYPE II HYDROGRAPHS



Total Inflow Summary Table

Time period
From: 08/28/2018, 12:00:00 AM
To: 09/01/2018, 12:00:00 AM

Thresholds
Exceedance: 0
Deficit: 0

Detention storage
Max flow: 0

Element ID	OUT_OFF_LAS_PALMAS	OUT_OFF_01	OUT_OFF_02	OUT_OFF_03	OUT_OFF_04	OUT_BP_1-2	OUT_BP_03	OUT_BP_04	OUT_BP_05	OUT_DRIVE_W	OUT_DRIVE_E
Maximum Total Inflow (cfs)	10.25	0.27	0.63	0.39	0.33	1.41	0.50	0.20	0.18	2.33	3.97
Minimum Total Inflow (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Event Mean Total Inflow (cfs)	0.14	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.07
Duration of Exceedances (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duration of Deficits (hrs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Exceedances	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Deficits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Exceedance (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume of Deficit (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Inflow Volume (ft³)	48757.36	895.2	1680.73	1038.23	874.66	4648.73	1318.96	577.47	481	9136.92	22732.97
Detention Storage (ft³)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Subbasin Summary

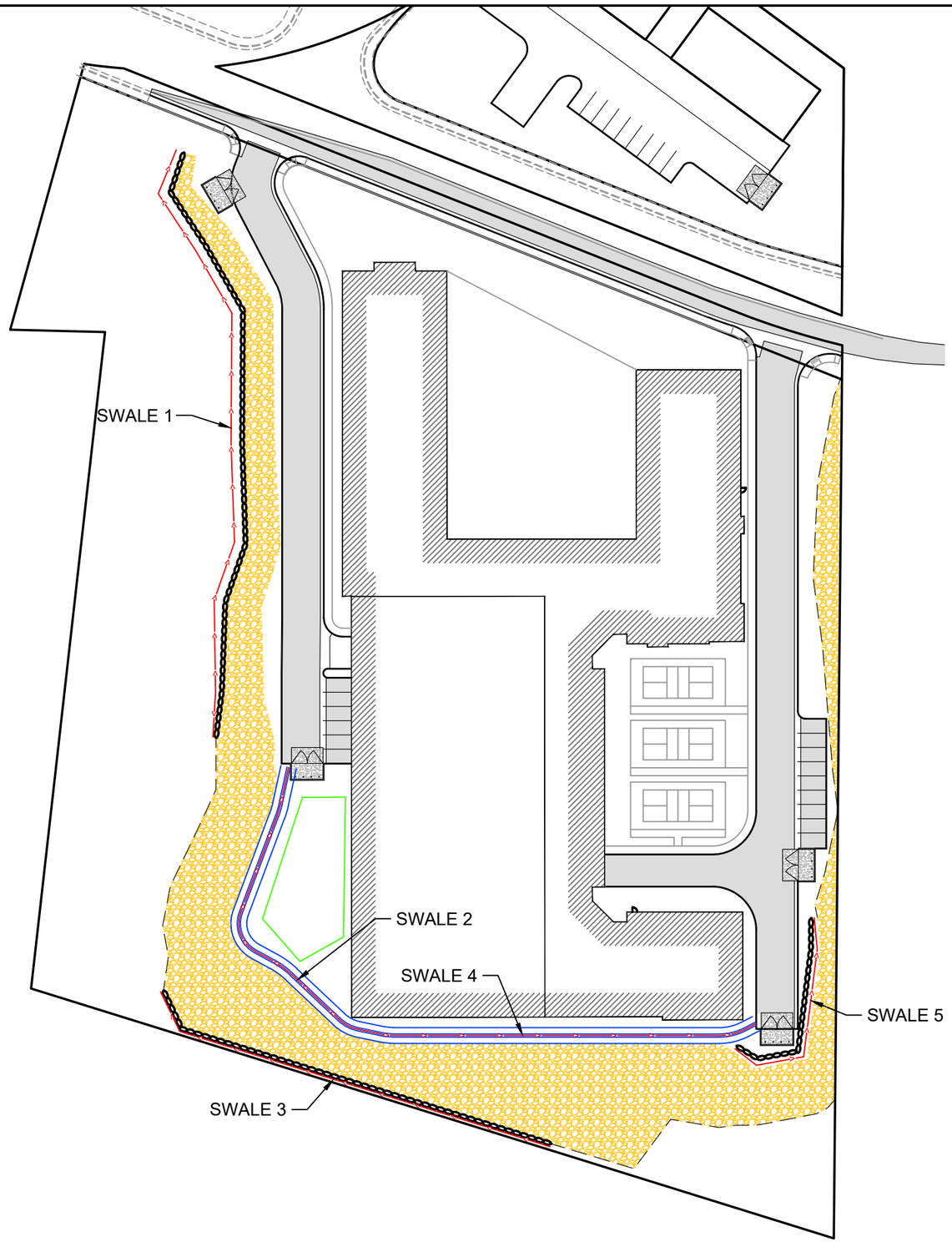
SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BAS_BLDG	1.80	0.00	98.00	2.51	2.28	4.10	2.37	0 00:51:39
2	BAS_BP_01	0.28	0.00	89.34	2.51	1.49	0.41	0.57	0 00:10:00
3	BAS_BP_02	0.62	0.00	88.00	2.51	1.39	0.87	0.98	0 00:19:16
4	BAS_BP_03	0.26	0.00	88.00	2.51	1.39	0.36	0.51	0 00:10:00
5	BAS_BP_04	0.07	0.00	98.00	2.51	2.27	0.16	0.20	0 00:10:00
6	BAS_BP_05	0.09	0.00	88.00	2.51	1.38	0.13	0.18	0 00:10:00
7	BAS_DRIVE_E	0.77	0.00	91.60	2.51	1.67	1.29	1.71	0 00:11:16
8	BAS_DRIVE_WEST	0.52	0.00	89.16	2.51	1.48	0.77	0.98	0 00:13:40
9	BAS_LS_E_01	0.18	0.00	88.00	2.51	1.39	0.24	0.31	0 00:13:23
10	BAS_LS_E_02	0.46	0.00	88.00	2.51	1.39	0.64	0.89	0 00:10:00
11	BAS_LS_W_01	0.92	0.00	80.43	2.51	0.92	0.84	1.15	0 00:10:00
12	BAS_LS_W_02	0.04	0.00	88.00	2.51	1.31	0.05	0.07	0 00:10:00
13	BAS_OFF_01	0.28	0.00	80.00	2.51	0.90	0.25	0.27	0 00:19:03
14	BAS_OFF_02	0.52	0.00	80.00	2.51	0.90	0.47	0.63	0 00:10:00
15	BAS_OFF_03	0.32	0.00	80.00	2.51	0.90	0.29	0.39	0 00:10:00
16	BAS_OFF_04	0.27	0.00	80.00	2.51	0.90	0.24	0.33	0 00:10:00
17	BAS_OFF_LAS_PALMAS	7.89	0.00	92.00	2.51	1.70	13.43	10.26	0 00:37:33
18	BAS_POOL	0.38	0.00	98.00	2.51	2.28	0.87	0.41	0 01:07:34

Appendix D – Drainage Channel Calculations and Details

Bush and Gudgell
205 East Tabernacle #4
St. George, UT 84770

www.bushandgudgell.com
Ph. 435-673-2337
Fax 435-673-3161

SCALE: 1" = 80'



SWALE INFO

NAME	CONTRIBUTING BASINS	FLOW IN (CFS)	DEPTH	BOTTOM WIDTH	SIDE SLOPES
SWALE 1	BAS_OFF_LAS_PALMAS BAS_BP_01 BAS_BP_02	9.41	2'	2'	2:1
SWALE 2	BAS_LS_W_01 BAS_LS_W_02 BAS_OFF_01 BAS_OFF_02	1.07	2'	2'	2:1
SWALE 3	BAS_LS_W_02 BAS_OFF_02	0.36	1'	0'	2:1
SWALE 4	BAS_LS_E_02 BAS_OFF_03	0.80	2'	2'	2:1
SWALE 5	BAS_LS_E_01	0.21	1'	0'	2:1

SWALE LOCATIONS

CANYON VIEW APARTMENTS
ST GEORGE, UTAH

BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
205 East Tabernacle Suite #4
St. George, Utah 84770
Phone (435) 673-2337 / Fax (435) 673-3161

PROJECT:	Canyon View Apartments	*PROJECT NO:*	221018	*DATE:*	1/31/2024
SUBJECT:	Drainage Swale Calcs	*ENGINEER:*	RM	*SHEET:*	

Swale 1 Calcs

Version: December 2010 / rmeyer

File Name: CE_Civil_Open_Channel_Steady_State_Flow.xls

Code Ref.: n/a

Choose Units	English
Channel Section	Trapezoidal, Triangle, Sqaure
Choose Mannings n	0.040 Rough rocks

Manning's Equation:

$$Q = \frac{\alpha * A^{5/3}}{n * P^{2/3}} \sqrt{S}$$

INPUT		
		Manning's n
y	1.00 ft	Water Depth
S	0.0088 ft/ft	Channel Slope
b	2 ft	Channel Bottom Width
mL	2 (horiz):1(vert)	Channel Side Slope, Left Side
mR	2 (horiz):1(vert)	Channel Side Slope, Right Side
OUTPUT		
Q	**10.114 cfs**	Open Channel Flow
V	**2.529 ft/sec**	
Tw	**6.000 ft**	Top Width (Gutter Spread)

S_s	2.8
D_{50}	**0.04 ft**

BUSH AND GUDGELL
205 East Tabernacle #4
St George, UTAH 84770
TEL: (435) 673-2337 • FAX: (435) 673-3161

PROJECT:	Canyon View Apartments	*PROJECT NO:*	221018	*DATE:*	1/31/2024
SUBJECT:	Drainage Swale Calcs	*ENGINEER:*	RM	*SHEET:*	

Swale 2 Calcs

Version: December 2010 / rmeyer

File Name: CE_Civil_Open_Channel_Steady_State_Flow.xls

Code Ref.: n/a

Choose Units	English
Channel Section	Trapezoidal, Triangle, Sqaure
Choose Mannings n	0.040 Rough rocks

Manning's Equation:

$$Q = \frac{\alpha * A^{5/3}}{n * P^{2/3}} \sqrt{S}$$

INPUT		
		Manning's n
y	0.33 ft	Water Depth
S	0.0071 ft/ft	Channel Slope
b	2 ft	Channel Bottom Width
mL	2 (horiz):1(vert)	Channel Side Slope, Left Side
mR	2 (horiz):1(vert)	Channel Side Slope, Right Side
OUTPUT		
Q	**1.098 cfs**	Open Channel Flow
V	**1.251 ft/sec**	
Tw	**3.320 ft**	Top Width (Gutter Spread)

S_s	2.8
D_{50}	**0.01 ft**

BUSH AND GUDGELL
205 East Tabernacle #4
St George, UTAH 84770
TEL: (435) 673-2337 • FAX: (435) 673-3161

PROJECT:	Canyon View Apartments	*PROJECT NO:*	221018	*DATE:*	1/31/2024
SUBJECT:	Drainage Swale Calcs	*ENGINEER:*	RM	*SHEET:*	

Swale 3 Calcs

Version: December 2010 / rmeyer

File Name: CE_Civil_Open_Channel_Steady_State_Flow.xls

Code Ref.: n/a

Choose Units	English
Channel Section	Trapezoidal, Triangle, Sqaure
Choose Mannings n	0.040 Rough rocks

Manning's Equation:

$$Q = \frac{\alpha * A^{5/3}}{n * P^{2/3}} \sqrt{S}$$

INPUT		
		Manning's n
y	0.43 ft	Water Depth
S	0.0061 ft/ft	Channel Slope
b	0 ft	Channel Bottom Width
mL	2 (horiz):1(vert)	Channel Side Slope, Left Side
mR	2 (horiz):1(vert)	Channel Side Slope, Right Side
OUTPUT		
Q	**0.357 cfs**	Open Channel Flow
V	**0.967 ft/sec**	
Tw	**1.720 ft**	Top Width (Gutter Spread)

S_s	2.8
D_{50}	**0.01 ft**

BUSH AND GUDGELL
205 East Tabernacle #4
St George, UTAH 84770
TEL: (435) 673-2337 • FAX: (435) 673-3161

PROJECT:	Canyon View Apartments	*PROJECT NO:*	221018	*DATE:*	1/31/2024
SUBJECT:	Drainage Swale Calcs	*ENGINEER:*	RM	*SHEET:*	

Swale 4 Calcs

Version: December 2010 / rmeyer
File Name: CE_Civil_Open_Channel_Steady_State_Flow.xls
Code Ref.: n/a

Choose Units	English
Channel Section	Trapezoidal, Triangle, Sqaure
Choose Mannings n	0.040 Rough rocks

Manning's Equation:

$$Q = \frac{\alpha * A^{5/3}}{n * P^{2/3}} \sqrt{S}$$

INPUT		
		Manning's n
y	0.14 ft	Water Depth
S	0.0764 ft/ft	Channel Slope
b	2 ft	Channel Bottom Width
mL	2 (horiz):1(vert)	Channel Side Slope, Left Side
mR	2 (horiz):1(vert)	Channel Side Slope, Right Side
OUTPUT		
Q	**0.804 cfs**	Open Channel Flow
V	**2.520 ft/sec**	
Tw	**2.560 ft**	Top Width (Gutter Spread)

S_s	2.8
D_{50}	**0.09 ft**

BUSH AND GUDGELL
205 East Tabernacle #4
St George, UTAH 84770
TEL: (435) 673-2337 • FAX: (435) 673-3161

PROJECT:	Canyon View Apartments	*PROJECT NO:*	221018	*DATE:*	1/31/2024
SUBJECT:	Drainage Swale Calcs	*ENGINEER:*	RM	*SHEET:*	

Swale 5 Calcs

Version: December 2010 / rmeyer

File Name: CE_Civil_Open_Channel_Steady_State_Flow.xls

Code Ref.: n/a

Choose Units	English
Channel Section	Trapezoidal, Triangle, Sqaure
Choose Mannings n	0.040 Rough rocks

Manning's Equation:

$$Q = \frac{\alpha * A^{5/3}}{n * P^{2/3}} \sqrt{S}$$

INPUT		
		Manning's n
y	0.26 ft	Water Depth
S	0.0294 ft/ft	Channel Slope
b	0 ft	Channel Bottom Width
mL	2 (horiz):1(vert)	Channel Side Slope, Left Side
mR	2 (horiz):1(vert)	Channel Side Slope, Right Side
OUTPUT		
Q	**0.205 cfs**	Open Channel Flow
V	**1.517 ft/sec**	
Tw	**1.040 ft**	Top Width (Gutter Spread)

S_s	2.8
D_{50}	**0.02 ft**

BUSH AND GUDGELL
205 East Tabernacle #4
St George, UTAH 84770
TEL: (435) 673-2337 • FAX: (435) 673-3161

Exhibit D
Grading Plan

GRADING NOTES

APPROXIMATELY 57,511 CU.YD. OF CUT, 6,246 CU.YD. OF FILL AND 51,265 CU.YD. OF **EXPORT** MATERIAL IS REQUIRED (FOR GRADING PERMIT ONLY). THE CONTRACTOR SHOULD VERIFY THE QUANTITIES FOR COMPLETION OF WORK. QUANTITIES ARE BASED ON FINISH GRADE OF ROADS & PADS.

ALL IMPORTED STRUCTURAL FILL SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO DELIVERY TO THE SITE. ALL IMPORTED STRUCTURAL FILL SHALL BE PLACED IN 8–INCH LOOSE HORIZONTAL LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF MAXIMUM DRY DENSITY (ASTM D–1557).

ALL EXCAVATION, GRADING AND FILL OPERATIONS WITHIN THE BUILDING AREA SHOULD BE OBSERVED BY THE GEOTECHNICAL ENGINEER TO VERIFY SUB–SOIL CONDITIONS AND DETERMINE ADEQUACY OF SITE PREPARATION, SUITABILITY OF FILL MATERIALS AND COMPLIANCE WITH COMPACTION REQUIREMENTS.

THE CONTRACTOR SHALL PROVIDE SUITABLE EQUIPMENT TO CONTROL DUST AND AIR POLLUTION CAUSED BY CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL ALSO PROVIDE SUITABLE MUD AND DIRT CONTAINMENT TO MAINTAIN THE WORK SITE, ACCESS ROADWAYS AND ADJACENT PROPERTIES IN A CLEAN CONDITION.

ALL EXCAVATION AND GRADING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF ST.GEORGE CITY AND APPENDIX J OF THE INTERNATIONAL BUILDING CODE, 2018 EDITION, AND THE SPECIFICATIONS AND REQUIREMENTS INCLUDED IN THE GEOTECHNICAL STUDY.

GEOTECHNICAL ENGINEER TO PROVIDE GRADING COMPLETION REPORT TO CONFIRM WORK HAS BEEN PERFORMED IN CONFORMANCE WITH THEIR RECOMMENDATIONS.

OWNER IS RESPONSIBLE FOR ALL ON–SITE DRAINAGE AND DETENTION.

LEGEND

- EXISTING GROUND CONTOUR
- FINISH GROUND CONTOUR
- LOT LINE
- RETAINING WALL
- LANDSCAPE DRAINAGE SWALE
- PAD: 00.00 — PAD ELEVATION IN FEET
- TW: 00.00 — TOP OF WALL ELEVATION IN FEET
- BW: 00.00 — BOTTOM OF EXPOSED WALL ELEVATION IN FEET
- FL: 00.00 — FL = FLOW LINE
- TC: 00.00 — TC = TOP OF CONCRETE
- TBC: 00.00 — TBC = TOP BACK OF CURB
- SLOPE IN RUN:RISE
- 2650 — CONTOUR ELEVATION IN FEET

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)

1 inch = 50 ft.

OWNER / DEVELOPER

SHAKESPEARE DEVELOPMENT GROUP

BEN SHAKESPEARE
(435) 703-4164
37 W 1070 S STE 101
ST GEORGE, UTAH 84770

ENGINEERING CONTACT

BUSH AND GUDGELL, INC.
205 EAST TABERNACLE #4
ST GEORGE, UT 84770

RICK MEYER - PROJECT MANAGER
(435)-673-2337

Preliminary.
For Review Only.
Not For
Construction.

No.	Date	By	Revision

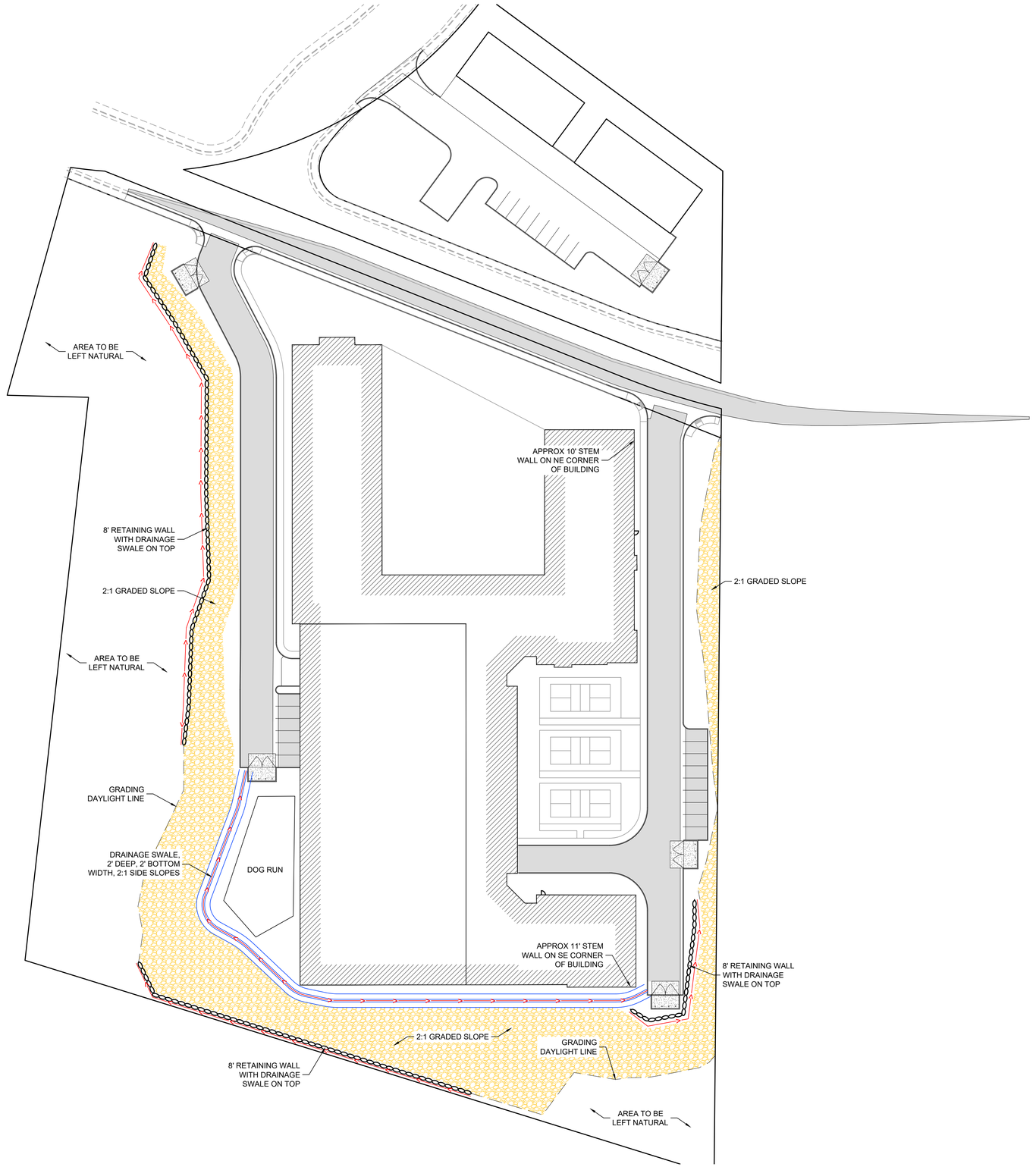
BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
205 East Tabernacle Suite #4
St. George, Utah 84770
Phone (435) 673-2337 / Fax (435) 673-3161
www.bushandgudgell.com

DATE: JAN 2024
DRAWN: RM
APPROVED:
SCALE: NOTED
JOB NO.: 221018

GRADING PLAN
CANYON VIEW APARTMENTS
ST GEORGE, UTAH

SHEET 2 OF 2 SHEETS
FILE:

Exhibit E
Site Plan



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.

Preliminary.
For Review Only.
Not For
Construction.

No.	Date	By	Revision

BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
205 East Tabernacle Suite #4
St. George, Utah 84770
Phone (435) 673-2337 / Fax (435) 673-3161
www.bushandgudgell.com

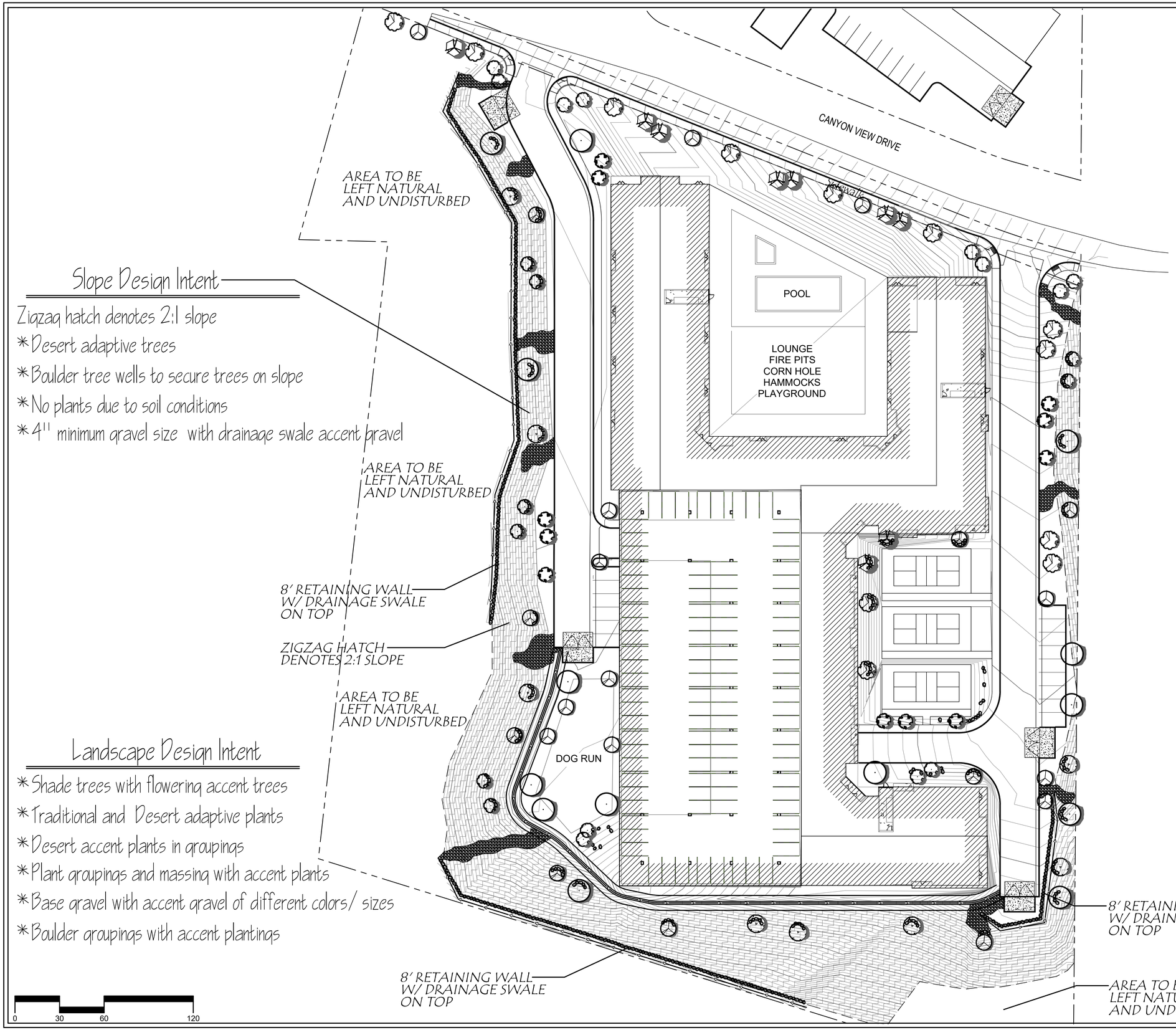
DATE: DATE
DRAWN: DRAWN
APPROVED: APPROVED
SCALE: SCALE
JOB NO.: 221018

SITE EXHIBIT
CAYON VIEW APARTMENTS

SHEET 1 OF 1 SHEETS
FILE: EXHIBIT

X:\221000-221999\221018 - Canyon View Apartments\221018 - SITE.dwg

Exhibit F
Landscape Plan



Slope Design Intent

Ziqzaq hatch denotes 2:1 slope

* Desert adaptive trees
* Boulder tree wells to secure trees on slope
* No plants due to soil conditions
* 4" minimum qravel size with drainaqe swale accent qravel

Landscape Design Intent

* Shade trees with flowering accent trees
* Traditional and Desert adaptive plants
* Desert accent plants in qroupinqs
* Plant qroupinqs and massinq with accent plants
* Base qravel with accent qravel of different colors/ sizes
* Boulder qroupinqs with accent plantinqs

PLANT PALETTE

TREES – MEDIUM SHADE TREES

NAME

Chilopsis linearis 'L. Hamilton'
Desert Willow

Olea europa 'Wilsonii'
Wilson Olive

Prosopis glandulosa 'maverick'
Maverick Honey Mesquite

Quercus virginiana
Live Oak

Pistachio chinensis
Chinese Pistache

TREES – SMALL, ACCENT FLOWERING

Vitex agnus–castus
Chaste Tree

Lagerstroemia indica
Crepe Myrtle

PALMS – Pool area only

Washingtonia filifera
California Fan Palm

Chamerops humilis
Mediterranean Fan Palm

SHRUBS – TRADITIONAL

NERIUM oleander 'Hardy Red'
Hardy Dwarf Oleander

ABELIA x grand. 'Sunrise'
Sunrise Variegated Abelia

Rosa x 'Noore'
Flowering Carpet Rose

ROSMARINUS o. 'Prostratus'
Prostrate Rosemary

SHRUBS – DESERT ADAPTIVE

LEUCOPHYLLUM langmaniae
Lynn's Legacy Ranger

LEUCOPHYLLUM f. 'Greencloud'
Texas Ranger

PEROVSKIA atriplicifolia
Russian Sage

SALVIA greggii
Red Sage

MUHLENBERGIA capillaris 'R. Mist'
Regal Mist Deer Grass

CHRYSACTINIA mexicana
Damianita

DESERT ACCENTS

DASYLIRION longissimum
Toothless Desert Spoon

DASYLIRION wheeleri
Desert Spoon

HESPERALOE parviflora
Red Yucca

AGAVE americana 'Marginata'
Varigated Century Plant

AGAVE parryi
Parry's Agave

Agave weberi
Weber Agave

COSTANZA PS ASSOCIATES
John J. Costanza
P.O. Box 3727
St. George, Utah 84771
Telephone 435 674 0606
CELL 435 862 8317
costanzalandsurvey@gmail.com

LICENSED LANDSCAPE ARCHITECT
JOHN J. COSTANZA
Expires 5/31/25
Signature
Date
97-328108-5301
STATE OF UTAH

CANYON VIEW APARTMENTS
CANYON VIEW DRIVE
ST. GEORGE, UTAH

no.	revisions	date	by

Scale: 1" = 30'-0"
Date: JAN. 22, 2024
Drawn By: JJC
Approved By:

CANYON VIEW APARTMENTS
LANDSCAPE SITE PLAN

North

Job No.
MISC.

Sheet No.
L–1
of 1

CANYON VIEW APARTMENTS
CANYON VIEW DRIVE
ST. GEORGE, UTAH

24x36 SHEET FORMAT

Exhibit G
Geotechnical Investigation

AGEC

Applied GeoTech

GEOTECHNICAL INVESTIGATION

CANYON VIEW APARTMENTS

ST. GEORGE, UTAH

PREPARED FOR:

SHAKESPEAR DEVELOPMENT
37 WEST 1070 SOUTH
ST. GEORGE, UTAH 84770

ATTENTION: BEN SHAKESPEAR

PROJECT NO. 2211499

NOVEMBER 6, 2024

1420 South 270 East • St. George, Utah 84790 • (435) 673-6850 • FAX (435) 673-1044

TABLE OF CONTENTS

SUMMARY

1. AGEC was requested to conduct a geotechnical and geological investigation to provide recommendations for the proposed Canyon View Property as shown on Figure 1. Our investigation included the excavation of 9 test pits and the drilling of 12 borings at the approximate locations shown on Figure 2.

2. The project is located on a hillside area where there is a moderate slope on the west and south sides of the property and th lower area slopes down less to the northest. There is approximately 70 feet of elevation change across the property. The entire site is underlain by the Chinle Formation and in particular the Petrified Forest Member of this formation. The member is also know as "blue clay" and expansive when wetted and also weak in strength when wetted. On adjacent properties, there are slopes to the east and northwest along the same ridge that have experienced slope failure and have required mitigation to stabilize. AGEC has evaluated the south and west slopes based on the proposed grading and have provided recommendations for design and construction of the project.

3. Due to the existing site topography, we anticipate significant amounts of retaining and grading. To assist in offsetting the amount of retaining required, we understand that portions of the retaining will be provided with the lower floor building walls being used as retaining walls. Depending on foundation types (micro piles or spread footings), AGEC should provide additional recommendations for design and construction for these walls.

4. The subsurface conditions across the site consist of varied thickness amounts of clay and gravel overlying mudstone. generally consist of varied thicknesses of silty sand, lean clay and silty gravel overlying mudstone bedrock. The mudstone bedrock is known as "blue clay" in the area and is moderately to highly expansive when significantly wetted.

5. The depth to mudstone is critical for limiting the potential amount of surface heave. Our experience has shown that approximately 15 feet of separation from the proposed grade to existing elevation of the mudstone is necessary to limit surface heave to less than 1 inch. The separation should be increased to 17 feet where the upper weathered portion of the mudstone is removed to allow the separation. The mudstone across the majority of the site will be less than the 15 feet depth and will need to be over-excavated to provide the separation. If the separation is provided by removing mudstone rather than raising the pad grade, our recommendation is to provide an overexcavation of 17 feet.

6. The on-site non-mudstone materials may be re-used as structural fill. The removed mudstone should be placed in non-structural or deeper fill zones of pavement/flatwork areas. Consideration may also be given to mixing the mudstone with non-expansive materials for re-use. AGEC has provided testing to allow a portion of the mudstone to be processed with additional moisture (4-6% over the optimum moisture content) and placed in the lower 5 feet (12-17 feet below grade) of the replacement zone of the overexcavation.

7. During the study(s), the portions of the site that have been previously graded contained varied amount of fill materials. These soils were primarily materials that were removed from the previous grading operations to the northwest portion of the property. The fill material is not properly compacted and will need to be removed and properly recompacted to support pavements and buildings. The majority of the fill materials are suitable to be re-used as fill. Portions of the fill contain debris or are mixed with mudstone.

8. Groundwater was encountered within Boring B-7 along the edge of the existing drainage that originates from the development above and west of the property. The drainage from this site should be piped through the site.

9. Site drainage recommendations should be implemented as recommended in the site drainage section of this report. We recommend that LID retention not be used on the site.

10. Detailed recommendations for subgrade preparation, materials, foundations, drainage and pavement are included in the report.

11. This summary should not be used independent of the information presented in the body of this report.

SCOPE OF WORK

AGEC was requested to conduct a geotechnical investigation and to provide geotechnical recommendations for the proposed Canyon View Apartments project. The property consists of two parcel with a smaller parcel located north of Canyon View Drive. The investigation covers both parcels, however, the north parcel is not part of our recommendations at this time, since there is no proposed details or construction to evaluate.

Our field investigation included the excavation of 9 test pits and the drilling of 12 borings to evaluate the subsurface conditions at the site. The locations of the explorations are shown on Figure 2. Laboratory testing was conducted on samples obtained during the field investigation to characterize the soils properties. In addition, borings B-11 and B-12 were drilled on adjacent properties above the slopes to characterize the subsurface profile for our slope evaluations.

AGEC has also reviewed the proposed grading plan at this time. The general recommendations for site grading, slope stabilization, retaining walls, foundations, pavement and drainage are included within this report.

SITE CONDITIONS

The property consists of two parcels with the northern parcel approximately 1 acre in size and the south parcel is approximately 6½ acres. The northern parcel has been filled with undocumented fill materials and slopes off to the north and east. This parcel is not part of the overall development at this time.

The remaining property is located south of Canyon View Drive. Located to the south and west is the Las Palmas Resort Development. The Las Palmas Resort is primarily several multi unit buildings that are multistory and are generally set back approximately 50 to 70 feet from the crest of the slope with exception to the northern most unit with is approximately 30 to

40 feet from the crests. The crest of the slope is generally on the Las Palmas Resort Property. Adjacent and to the east of the property is undeveloped property.

The property is primarily a sloping property with approximately 60 feet of elevation change from the SWC to the NEC. The steeper portions of the property are along the west and south portions of the property and the remainder of the property continues to slope to the northeast with less steepness.

There are several areas of the site that have been disturbed or previously graded. The Las Palmas area was developed in the 1980's and 1990's. During the grading it is our understanding from conversations with local excavators that there was a haul road that was used on the lower portion or on the west and south slopes of the property. This old road is visible in aerial photos. In addition, some fill piles exist on the northern portion of the site. There is a storm drain that exits onto the property from the Las Palmas Resort near the west center of the property. There is a drainage structure (drop box) and storm drain pipe that has been installed at the end of the roadway. This drainage seeps flows periodically along with landscape overflow water through the pipe and onto the surface to the east and northeast. There is a moderate amount of vegetation consisting of brush and small trees along this initial portion fo the drainage path. The remainder of the site has sparse amounts of desert brush and small vegetation.

SUBSURFACE SOIL AND BEDROCK CONDITIONS

AGEC has evaluated the subsurface conditions on the site with the excavation of 9 test pits and the drilling of 12 borings at the locations shown on Figure 2. The pits were excavated using a small excavator. The borings were drilled with a truck mounted drill rig using solid and hollow stem augers to drill and periodic samples taken. The boring and test pit logs are shown on Figures 3 through 6 with notes, key and legend to the borings and test pits on Figure 7.

In general, the subsurface conditions consist of varied amounts of fill, silty sand, lean clay and silty gravel overlying mudstone bedrock. There was a layer of sandstone bedrock within boring B-1 above the mudstone. The fill was previously undocumented fill that was either dumped or spread on the property. The fill was encountered within Borings B-2, B-3, B-7, B-9 and B-11. The depth to mudstone varied in 2 to approximately 38 feet across the property. Generally the mudstone was within 5 to 15 feet below the surface through the majority of the site. The various types of soil/bedrock are described below:

Fill: The fill is generally undocumented or was not placed in a controlled or properly compacted manner. The fill consists of various type of materials consisting of lean clay (excavated mudstone), or silty sand and gravel. The fill was generally brown to grey in color.

Lean Clay (CL): The lean clay contained varied amounts of sand, occasional gravel and was generally stiff to very stiff, moist and varied in color from brown to grey to red.

Silty Sand (SM): The silty sand was generally encountered near the surface of the site and was medium dense in the upper 2 to 3 feet with dense and slightly to moderately cemented below. The material was light brown to grey in color and slightly moist to wet.

Clayey Gravel (GC): The clayey gravel contained varied amounts of clay mixed with small cobbles. The clayey gravels were generally near the surface and were primarily mixed as a part of the surface erosion process. generally dense with portions of the gravel being moderately cemented. The silty gravel varies from slightly moist.

Silty Gravel (GM): The silty gravel contained varied amounts of small cobbles and occasional boulders. The silty gravel is generally dense with portions of the gravel being moderately cemented. The silty gravel varies from slightly moist to wet.

Sandstone Bedrock: The sandstone is soft to moderately hard, occasional clayey zones, grey to brown in color.

Mudstone Bedrock: The mudstone is generally known in the area as "blue clay". It is soft to moderately hard, moist to wet and varies from grey to red to purple in color. The mudstone is medium to highly plastic and varies from low to highly expansive.

The boring and test pits logs are provided on Figures 3 through 6 with the Legend and Notes to Exploratory Borings and Test Pits on Figure 7. The laboratory tests are also shown on the logs and summarized on Table 1, Summary of Laboratory Test Results. The consolidation tests are shown graphically on Figures 8 to 13.

SUBSURFACE WATER

Groundwater was observed in several of the borings including the deeper borings of B-11 and B-12 on the Las Palmas Property. The other boring was Boring B-7 near the drainage area from off the Las Palmas property. Typically the groundwater is perched over the bedrock or seeping through layers within the bedrock. The groundwater is likely the result of long term surface infiltration from the landscape watering above the property.

Fluctuations in the groundwater will occur over time and the fluctuations of the groundwater levels are beyond the scope of this study.

GEOLOGIC HAZARD EVALUATION

AGEC has reviewed the geologic literature and based on our review, there two significant items that require evaluation. The potential for landslides or slope instability is high along the south and west slope with the potential for expansive soils/rock throughout the site. These hazards were evaluated by AGEC to provide recommendations for design and construction to mitigate the effects of the potential hazards.

A. SLOPE STABILITY

Borings B-11 and B-12 were drilled to provide information on the subsurface conditions in areas of the proposed development where significant grading is being contemplated for the development. The logs of Borings B-11 and B-12 are presented on Figure 6. Our analysis is based on a proposed grading plan prepared by Bush and Gudgell for the Canyon View Apartments provided to us on September 20, 2024.

The ground surface, southwest of the building, slopes down from elevation 2,734 feet to 2,700 feet, which is a difference of 34 feet over approximately 42 feet (1.2:1, horizontal to vertical).

The grade, south of the building, changes from 2,738 feet down to 2,689 feet. This results in an overall slope with a drop in elevation of 45 feet over a distance of 60 feet (1.3:1, horizontal to vertical).

1. Background

   The site proposed for development is located in a general area of previous ground movement. We are aware of two areas where there was landslide movement. One was located approximately 1,500 feet to the northwest and a second approximately 1,000 feet to the southeast.

   Our involvement on the event located to the southeast has provided us with information that has been incorporated into this analysis.

2. Soil Characteristics

   A critical issue in regard to the stability of slopes in this area is the likely presence of weak layers of soil within the bedrock that are sloped down at an angle of approximately 7 degrees and oriented in a northeast direction. Unfortunately, this characteristic is also in the direction of proposed new slopes that slope down in that same general direction.

The weak layer was the primary contributing factor to the movement experienced to the southeast of the site and resulted in back calculated strengths that were incorporated in this analysis.

Listed below is a table summarizing the materials encountered within the two borings that potentially will be impacted by the proposed change of grade.

Index Property	Low	High	Average	No. of Samples Tested
Moisture Content (%)	1	13	9	9
Dry Density (pcf)	86	123	105	6
Degree of Saturation (%)	37	70	57	6
Grain Size Distribution -200 sieve (silt and clay size)	6	93	59	9
Clay Fraction	17	27	22	3
Atterburg Limits				
Liquid limit (%)	24	48	38	7
Plasticity Index (%)	NP	27	21	7

Based on the characteristics of the soil and the index properties, the following strength values have been used in our analysis.

Material	Unit Weight (pcf)	Φ′ (degrees)	c′ (psf)
Gravel	135	38	0
Mudstone	125	17	900
Mudstone Weak Plane	125	21	0

3. Findings

In order to achieve appropriate factors of safety, all excavation slopes in the upper granular soil should be adjusted to be at a slope of 2.1:1, (horizontal to vertical) or flatter, which is slightly flatter than the 2:1 that is currently used in design.

Our stability analysis of the area south of the building indicates that the south basement walls will need to help support the slope by providing a buttress. The following conditions are needed to achieve a static factor of safety of 1.5.

Location	Lateral Buttress Loads (psf)
Garage South Wall	
West Corner	800
Mid-Point	
Floor at elevation of 2,700 feet	600
Floor at elevation of 2,689 feet	1,400
East Corner	
Apartments South Wall	250
West Corner	250
East Corner	65

The loads provided above apply at the locations indicated. Values can be linearly adjusted between the specific locations.

With the necessity of providing a buttress load we recommend that the design team consider what options they may have to either permanently improve the strength of the slope or provide a structural buttress as indicated above to maintain stability.

The factor of safety drops below 1 under seismic events. The amount of deformation under a major seismic event (2% in 50-years) would result in less than 4 inches of displacement.

4. Upper Rockery Retaining Wall South of Parking Structure

The 10-foot-high rockery, proposed to be located south of the facility will need to have reinforcement that extends behind the face of the rockery. In addition to the reinforcement needed for the rockery, additional length is needed for the overall slope stability. For planning purposes, we suggest that the length of the grid extend at least 20 feet beyond the face of the rockery on the west end of the rockery increasing to a distance of 30 feet at the location closest to the southwest corner of the parking structure. The 30-foot grid length will then continue to the east end of the rockery.

As project design proceeds, we recommend that the buttress loads and the grid designs be reviewed to verify that the design maintains the stability of the south slope.

5. Further Recommendations

The soil and bedrock strengths in the hillside need to remain similar to what has been used in this analysis in order for the stability to be maintained. This can be achieved by keeping the moisture conditions as they currently are, and drier if possible.

Recommendations to maintain if not to improve the current moisture conditions include:

- Collect and remove surface water that comes onto the property from off and on the site.

- The drainage system needs to be watertight. This type of construction is not standard and therefore would require specific attention to verify that the improvements are watertight. This would also include not storing storm water on site without positive methods to eliminate and verify that the water is not seeping into the subgrade.

- Waterways should be lined to prevent seepage into the ground.

- Positive measures need to be taken to eliminate the potential for water to ever pond on the site and on the hillside.

- Eliminate landscaping that requires irrigation as much as possible.

PROPOSED CONSTRUCTION

We understand the project will consist of a large Apartment Building with underground parking. The concept plan is shown on Figure 2. The building will be reinforced concrete on the lower sections and wood framed above grade. The parking garage will have two levels with the north eastern level being 2678 feet, the next tier to the south and west being 2689 feet. The main floor will be 2700 feet. There are planned to be several amenities including pickle ball courts and a possible swimming pool. We anticipate relatively heavy wall loads on the order of 6 to 8 kips per lineal foot with column loads up to 150 kips.

The public improvements will also include utilities and the widening of Canyon View Drive.

As more details of the proposed construction are known, AGEC should review and update our recommendations.

RECOMMENDATIONS

Based on subsurface soil conditions, engineering analysis, and the proposed construction, the following recommendations are provided:

A. **Site Grading**

Based on the grading plan provided by Bush & Gudgell Engineering, there are cuts on the order of up to approximately 30 feet on the south end of the site with the majority of the building area being a cut with the deeper section being about a 10 foot step below the adjacent near surface area. Ther are fills on the west center upper level part of the bing and along the majority of the northwestern portion of the site. The fills will be up to approximately 12 feet.

1. Subgrade Preparation

General: Prior to placing fill, the site should be grubbed to remove vegetation and soil containing roots and organics. The amount of materials will vary with the type of vegetation and location. These materials should be disposed off site.

Subsequent to grubbing and prior to placing fill, the subgrade preparation will vary across the site for different conditions as follows:

Roadways: The subgrade is anticipated to vary from silty sand and gravel to mudstone. We recommend a separation of at least 3 feet between the mudstone and pavement subgrade.

Building Pads: Pads that are located within a cut zone should be overexcavated to at least 2 feet below the proposed pad grade to provide a uniform pad. In areas where the building pad is not at least 15 feet above the mudstone, the mudstone should be overexcavated to remove the mudstone down to a depth of at least 17 feet below pad grade. AGEC should verify removal of the mudstone. The contractor should provide verification of the limits and depths by survey.

2. Excavation

In general, we anticipate that excavation of the bedrock at the site will likely require heavy duty excavation equipment.

3. Grading Slopes and Trenches

The following table provides the maximum recommended slope steepness for Sa given slope condition. Slopes should include benches in accordance with the 2021 IBC.

Slope Condition	Maximum Slope (Horizontal:Vertical)
Permanent Cut Slopes in Overburden Soils*	2.1:1
Unretained, Properly Compacted Fill	2:1
Utility Trenches in Bedrock (OSHA Soil Class A)	½:1

*see slope stability recommendations in the slope stability section above.

Fill slopes should be graded by overbuilding and then cutting back to the desired grade to provide a compacted slope face. Fill placed on existing slopes steeper than 3:1 should be placed using a benching procedure to key the fill into the existing slope. Benches should be of sufficient width to allow adequate area for the compaction equipment.

Steeper trenches may require the use of shoring or a trench box to provide as safe work environment. Safe trench excavation is the responsibility of the contractor.

4. Materials

The majority of the fill materials anticipated at the site will likely consist of silty sand, gravel and clay along with mudstone or sandstone bedrock. The majority of the soils are dry and will need to be moisture conditioned prior to use as fill. AGEC has evaluated the re-use of the mudstone in the lower 5

feet (12-17 feet below pad grade) of the deep overexcavation areas (see Fig 14). These materials may be used by wetting (marinating) the soil with 4 to 6 percent over the optimum moisture content and allowing to cure or marinate for 24 to 48 hours prior to placement or compaction. The materials should then be placed and compacted to approximately 90 to 95 percent of the maximum dry density as determined by ASTM D-698. The over compaction may result in additional heave. It is critical achieve the proper moisture and compaction range if these soils are re-used in the deeper excavation process.

Consideration may also be given to mixing the mudstone with non-expansive materials for re-use. Typically, a ratio of 2:1 (non expansive to mudstone) may be used in deeper fill zones. AGEC can provide additional laboratory testing upon request to provide recommendations for mixing ratios. We do not recommend that mixed materials be used in the upper 5 feet of building pads.

If additional materials are Imported, the materials should be non-expansive, non-gypsiferous, granular soil. Listed below are the materials recommended for imported fill.

Area	Fill Type	Recommendations
Foundations/slabs	Site grading/ structural fill	**-200** <35%, **LL** <30% Maximum size: 4 inches Solubility < 1%
Underslab (upper 4 inches)	Base Course	-200 <12% Maximum size: 1 inch Solubility < 1%

-200 = Percent Passing the No. 200 Sieve

LL = Liquid Limit

5. Compaction

Compaction of materials placed at the site should equal or exceed the following minimum densities when compared to the maximum dry density as determined by ASTM D-1557:

Area	Percent Compaction
Subgrade	90
Footings/building pad	95
Site grading	95
Utility trenches	95
Wall backfill	95

To facilitate the compaction process, the overburden soil and processed, non-expansive bedrock should be moisture conditioned to within 2 percentage points of the optimum moisture content as determined by ASTM D-1557 prior to placement.

Fill should be placed in loose lift thicknesses which do not exceed the capacity of the equipment being utilized. Generally, 6 to 8-inch loose lifts are adequate. Lift thicknesses should be reduced to 4-inches for hand compaction equipment.

6. Surface Drainage

Positive site drainage should be maintained during the course of construction. After construction has been completed, positive drainage of the surface water away from the buildings in each direction must be maintained. To reduce infiltration adjacent to foundations we recommend the following:

a. A minimum slope of 6 inches in the first 10 feet from the perimeters of the structures should be provided.

b. Roof gutter systems should be installed around the perimeters of the structures. Roof downspouts should discharge away from the buildings so as to prevent ponding adjacent to foundations. We recommend piping roof gutter downspouts of site directly into the adjacent curb and gutter.

c. Placement of 3 to 4 foot wide concrete aprons around the perimeters of the structures.

d. Landscaping requiring water should not be placed adjacent to foundations or within 10 feet of foundations.

e. Due to the presence of the underlying expansive layers, we recommend protection of the underlying foundation support soils with a 10 mil impermeable PVC membrane. The membrane should be attached to the perimeter foundation of the residence and slope away from the residence at a 5 percent slope into a perimeter drain trench to collect and discharge water off site. The drain trench should include gravel and a 4 inch perforated PVC pipe to collect and transport water off site. It is critical the line extend into line both sides and the bottom of the trench.

f. Below grade portions of walls/fences which are backfilled with soil should be protected with an impermeable membrane and a subsurface drain on the backfilled side. A gravel covered, perforated PVC pipe should also be placed at the base of the wall to carry water to a discharge point. This is intended to reduce the potential for salt weathering and sulfate attack on concrete/masonry.

7. Low Impact Development (LID) Drainage

AGEC has reviewed the planned areas for surface infiltration areas shown as LID on the grading plans and the Dixie Storm Water Coalition Guide (DSWCG) for Low Impact Development (Ref No. 1) and provided the following evaluation:

Using the reference No. 2 for determining the USDA mapped soil, there are several soil types including "WBD" or Winkel, gravelly fine sandy loam, "NLE" and "EB"- Eroded land Shalet complex. The site has a Hydrologic Soil Group of D. Our evaluation Geotech evaluation has shown that we have shallow mudstone bedrock. There is also localized groundwater conditions.

Using the DSWCG, Figure 2 (flow chart), and based on the soil types and conditions, Steps- 1-3 are "No" due to the shallow bedrock on the site. Based on the rock conditions, we do not recommend using any of the Best Method Practices (BMP's) within Reference No. 1.

The following parameters may be used in the application-Template form:

Subsurface Information	
Groundwater	
Depth to Groundwater (ft)	Varies
Historical High Depth to Groundwater if known (ft)	Not Known
Source	Geotech Study
Groundwater Contamination at Site:	N/A
Soil Information	
Infiltration Rate (in/hr) [Ref No. 3]	< 1
Hydrologic Soil Group/Map Unit Symbol:	D
Source:	USDA Web Site Ref. No. 2
Soil Contamination at Site:	N/A

Due to the underlying expansive mudstone the groundwater will perch to create an artificial groundwater condition, which exists on portions of the site from the development to the north. The perching will likely result in lateral movement of water and resulting in the introduction of water to locations that may be a concern, such as utility trenches, next to slopes that would reduce stability and cause seepage concerns. We would recommend that infiltration be limited and that the basin areas be allowed to overflow into storm drainage that allows water to leave the property to regional drainage areas.

B. Foundations

1. Conventional spread and spot footings:

Foundation subgrade should be prepared as outlined above in order to utilize conventional foundations.

The following foundations recommendations may be used

a. Bearing Material

The proposed residences may be supported on conventional spread footings bearing on properly compacted structural fill underlain by a properly prepared subgrade. Specifically, the subgrade should be prepared during site grading by overexcavating the building pads to remove unsuitable soils as recommended in the Subgrade Preparation section of this report. Imported structural fill should be used in the upper 2 feet below foundations.

b. Bearing Pressures

Footings bearing on properly compacted structural fill may be designed for the following net allowable bearing pressures.

Load Condition/Foundation width (ft)	Net Allowable Bearing Pressure (psf)
Walls (2 ft)	2,000
Walls (2-3 ft)	2,500 psf
Walls (3-4 ft)	3,000 psf
Columns (2-4 ft)	2,500 psf
Columns (4-6 ft)	3,000 psf
Columns (6-8 ft)	3,500 psf

c. Footing Width and Embedment

Footings should have a minimum width of 18 inches and should be embedded at least 12 inches below the lowest adjacent grade.

d. Temporary Loading Conditions

The allowable bearing pressures may be increased by one-half for temporary loading conditions such as wind or seismic loads.

e. Settlement

We estimate that settlement will be approximately 1 inch for footings designed as indicated above due to the load of the structure. Differential settlement is estimated to be approximately ½ inch.

f. Foundation Base

The base of excavations should be cleared of loose or deleterious material prior to placement of fill or concrete.

C. Concrete Slab-on-Grade

1. Slab Support

   Concrete slabs may be supported on a zone of properly prepared (overexcavated) and compacted fill as stated in the Subgrade Preparation and Materials sections of this report with a minimum thickness of at least 12 inches.

2. Underslab Base Course

   A 4-inch layer of properly compacted base course should be placed below slabs to provide a firm and consistent subgrade and promote even curing of the concrete.

3. Vapor Barrier

   A vapor barrier should be placed below slabs in areas which will receive sensitive floor coverings or coverings which are impermeable. Vapor barriers also provide protection from salt and sulfate attack.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

   Lateral resistance for spread footings is controlled by sliding resistance developed between the footing and the subgrade soil. An ultimate friction value of 0.40 may be used in design for ultimate lateral resistance of footings bearing on properly compacted on-site soils. The friction value may be increased to 0.45 if the foundations bear on imported structural fill.

2. Retaining Structures

   The following equivalent fluid weights are given for design of subgrade walls and retaining structures. The active condition is where the wall moves away from the soil. The passive condition is where the wall moves into the soil and the at-

rest condition is where the wall does not move. We recommend the basement walls be designed in an at-rest condition.

The values listed below assume a horizontal surface adjacent the top and bottom of the wall.

Description	Active	At-Rest	Passive
Granular Backfill - Equivalent Fluid Weight	35 pcf	55 pcf	325 pcf
Granular Backfill- Earth Pressure Coefficient (Processed/mixed mudstone)	0.28	0.44	-
Fine-Grained Backfill - Equivalent Fluid Weight	50 pcf	65 pcf	190 pcf
Fine-Grained backfill - Earth Pressure Coefficient	0.36	0.55	-

Care should be taken to prevent percolation of surface water into the backfill material adjacent to the retaining walls. The risk of hydrostatic buildup can be reduced by placing a subdrain behind the walls consisting of free-draining gravel wrapped in a filter fabric.

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be modified as follows according to the Mononobe-Okabe method assuming a level backfill condition:

Lateral Earth Pressure Condition	Seismic Modification (2% PE in 50 yrs)	
	Granular Backfill	Fine-Grained Backfill
Active	9 pcf increase	10 pcf increase
At-rest	no increase	no increase
Passive	22 pcf decrease	16 pcf decrease

The resultant of the seismic increase should be placed up ½ the distance up from the base of the wall.

4. Safety Factors

The values recommended assume mobilization of the soil to achieve the assumed soil strength. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Seismicity, Liquefaction and Faulting

1. Listed below is a summary of the site parameters as required by the 2021 International Building Code and ASCE 7-16:

Description	Seismic Parameter
	2,500 yr event (≈2% PE in 50 yrs)
Site Class	C
S_s (0.2 second period)	0.49g
S_1 (1 second period)	0.16g
PGA	0.22g
F_a	1.3
F_v	1.5
F_{pga}	1.2

The values provided above were generated using the ASCE 7-16 Seismic Hazard Tool. Based on the observed subsurface conditions, a ground motion hazard analysis (GMHA) as per ASCE 7-16 is not required by the 2021 International Building Code.

2. Liquefaction

Based on subsurface conditions encountered in the borings and the test pits, the subsurface soils and bedrock observed are non-liquefiable during a seismic event.

3. Faulting

Based on a review of available geologic literature, there are no mapped faults extending near or through the site.

F. Soil Corrosion

Based upon our experience in the area, the on-site soils, bedrock, and many imported sources may contain sulfates in sufficient concentration to be corrosive to concrete. Therefore, we recommend concrete elements that will be exposed to the on-site soils be designed in accordance with provisions provided in the American Concrete Institute Manual of Concrete Practice (ACI) 318-14. Tables 19.3.1.1 and 19.3.2.1 of ACI 318-14 should be referenced for design of concrete elements utilizing a Sulfate Exposure Class of S2.

Consideration should also be given to cathodic protection of buried metal pipes. We recommend utilizing PVC pipes where local building codes allow.

G. Roadway-Pavements

1. Subgrade Support

We anticipate that the subgrade materials beneath the pavement areas will consist of silty to clayey sand or compacted fill materials. The subgrade should be prepared as outlined in the subgrade preparation section of this report. A California Bearing Ratio (CBR) of 10 percent was assumed for a properly compacted subgrade for purposes of design.

2. Pavement Thickness

Based on the assumed traffic loadings and St. George City traffic indexes, a 20-year design life, and AASHTO design methods, the following pavement sections are recommended.

FLEXIBLE PAVEMENT SECTIONS				
Roadway	**Traffic Index**	**ROW**	**Asphaltic Concrete (inches)**	**Base Course (inches)**
Canyon View Drive	7	80	4	8
Interior Parking	5	NA	2.5	6
Traffic/Access	5	NA	3	6

3. Pavement Materials

The pavement materials should meet City of St. George specifications for gradation and quality. The pavement thicknesses indicated above assume that the base course is a high quality material with a CBR of at least 50 percent and the asphaltic concrete has a minimum Marshall stability of 1,800 pounds. Other materials may be considered for use in the pavement section. The use of other materials may result in other pavement material thicknesses.

4. Drainage

   The collection and diversion of drainage away from the pavement surface is extremely important to the satisfactory performance of the pavement section. Proper drainage should be provided.

H. Construction Testing and Observations

We recommend the following testing and observations be done as a minimum as required by the City of St. George.

1. Observe grubbing and verify removal of soil containing roots and organics.

2. Verify that recommended overexcavation depths are achieved in the building pads and beneath roadways. The lateral extent of the building pad should be located by survey (not included in AGEC's Scope of Services) and include the area which extends at least 5 feet beyond the buildable area as per city set-back requirements. Additional test pits and engineering observation may be necessary during site/pad grading to assist in locating and defining the potentially expansive layers of mudstone bedrock.

3. After mass grading is complete, additional exploration will be necessary in cut areas to verify subsurface conditions and the depth to underlying potentially expansive layers of bedrock.

4. Verify that recommended structural fill depths are provided below foundations and slabs.

5. Conduct compaction testing on fill placed below foundations and in building pads. We recommend testing each foot of fill placed.

6. Conduct construction materials testing on city improvements at a frequency which meets or exceeds St. George City requirements.

I. Geotechnical Recommendation Review

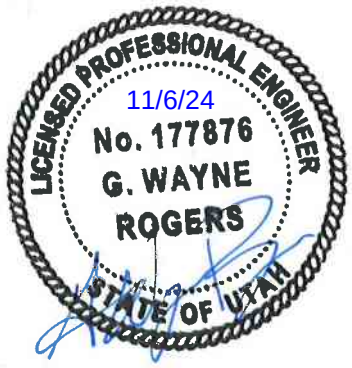
The client should familiarize themselves with the information contained in this report. If specific questions arise or if the client does not fully understand the conclusions/recommendations provided, AGEC should be contacted to provide clarification.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the field and laboratory testing, the information from the referenced studies and our experience in the area. Variations in the subsurface conditions may not become evident until excavation is conducted. If the subsurface conditions are found to be significantly different from those described above, we should be notified to reevaluate our recommendations.

If you have any questions or if we can be of further service please call.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



G. Wayne Rogers, P.E.

James E. Nordquist, P.E.

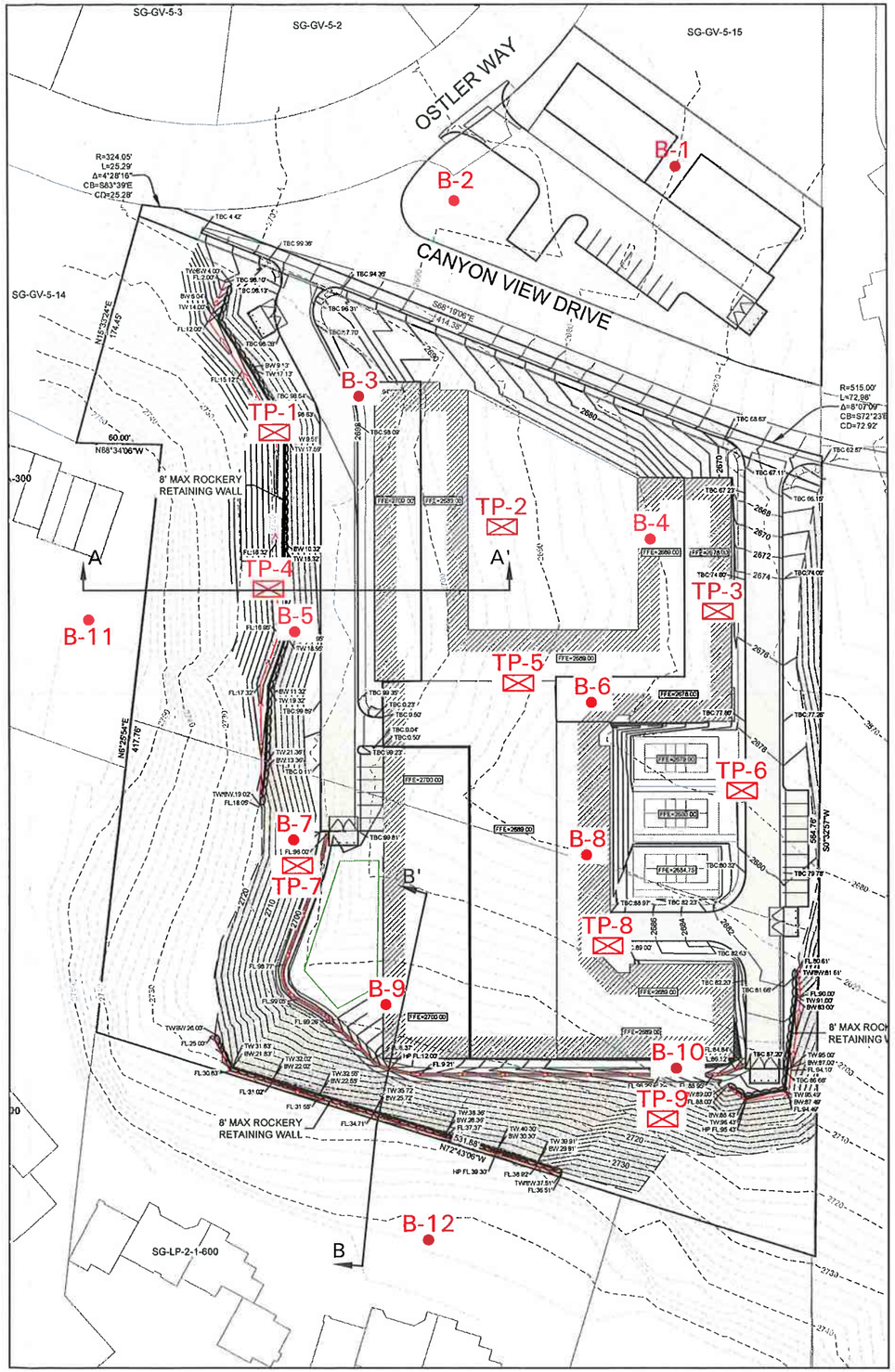
CANYON VIEW APARTMENTS
ST. GEORGE, UTAH

N

Not to Scale

2211499	AGEC	Vicinity Map	Figure 1

CANYON VIEW APARTMENTS
ST. GEORGE, UTAH



⊠ Approximate test pit location

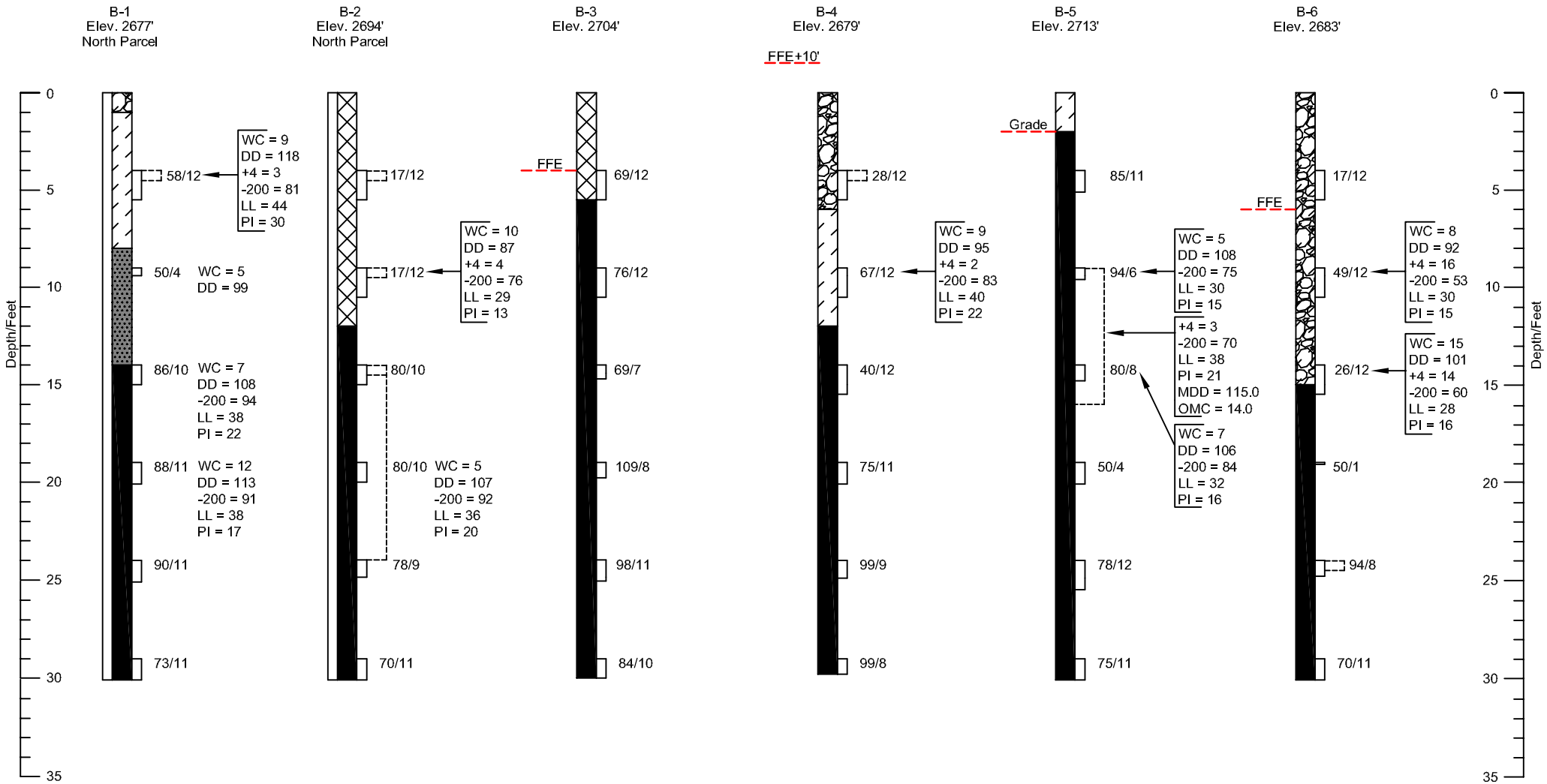
● Approximate boring location

Slope evaluation cross-sections

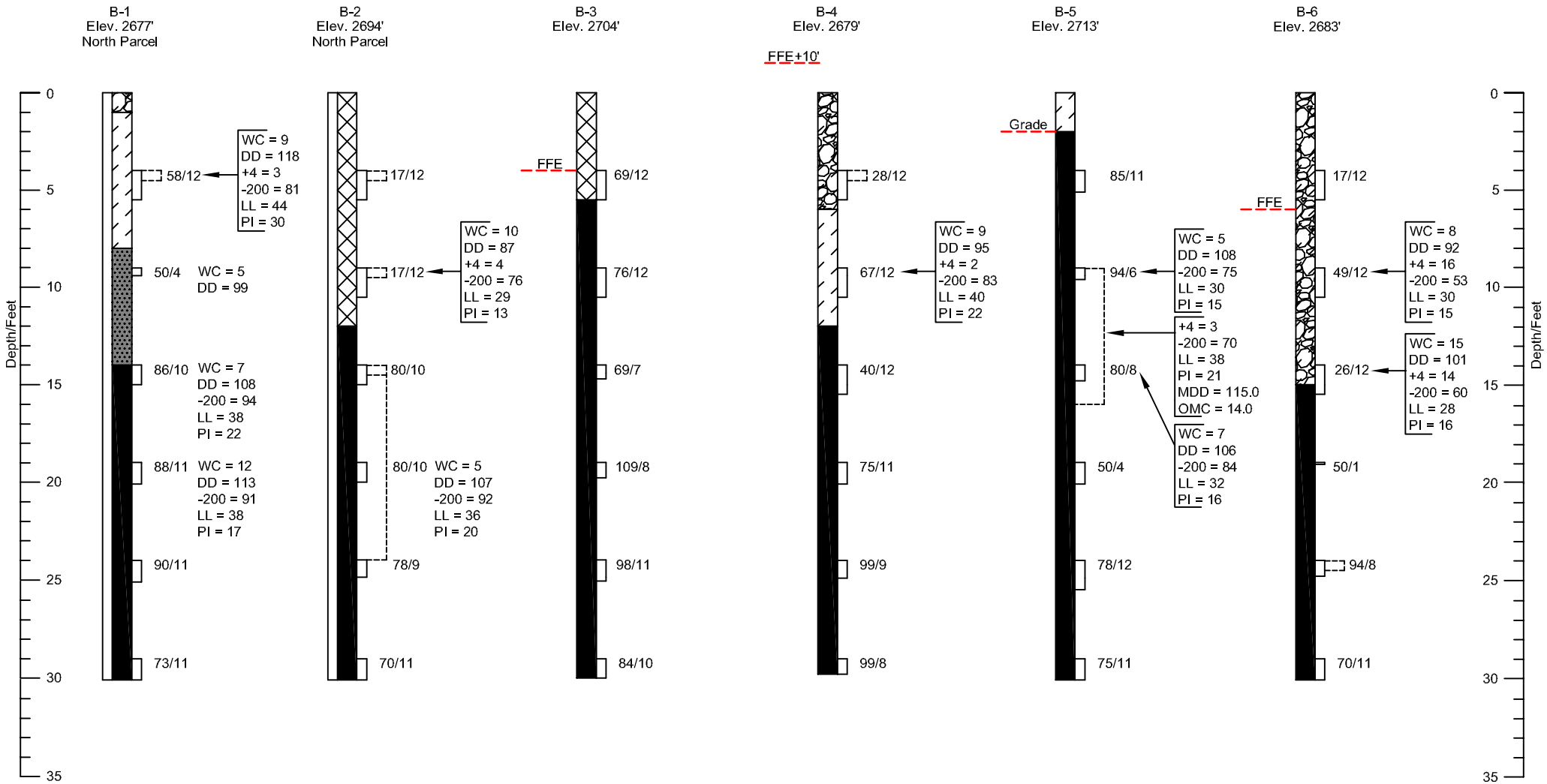
N

0 100 200 feet

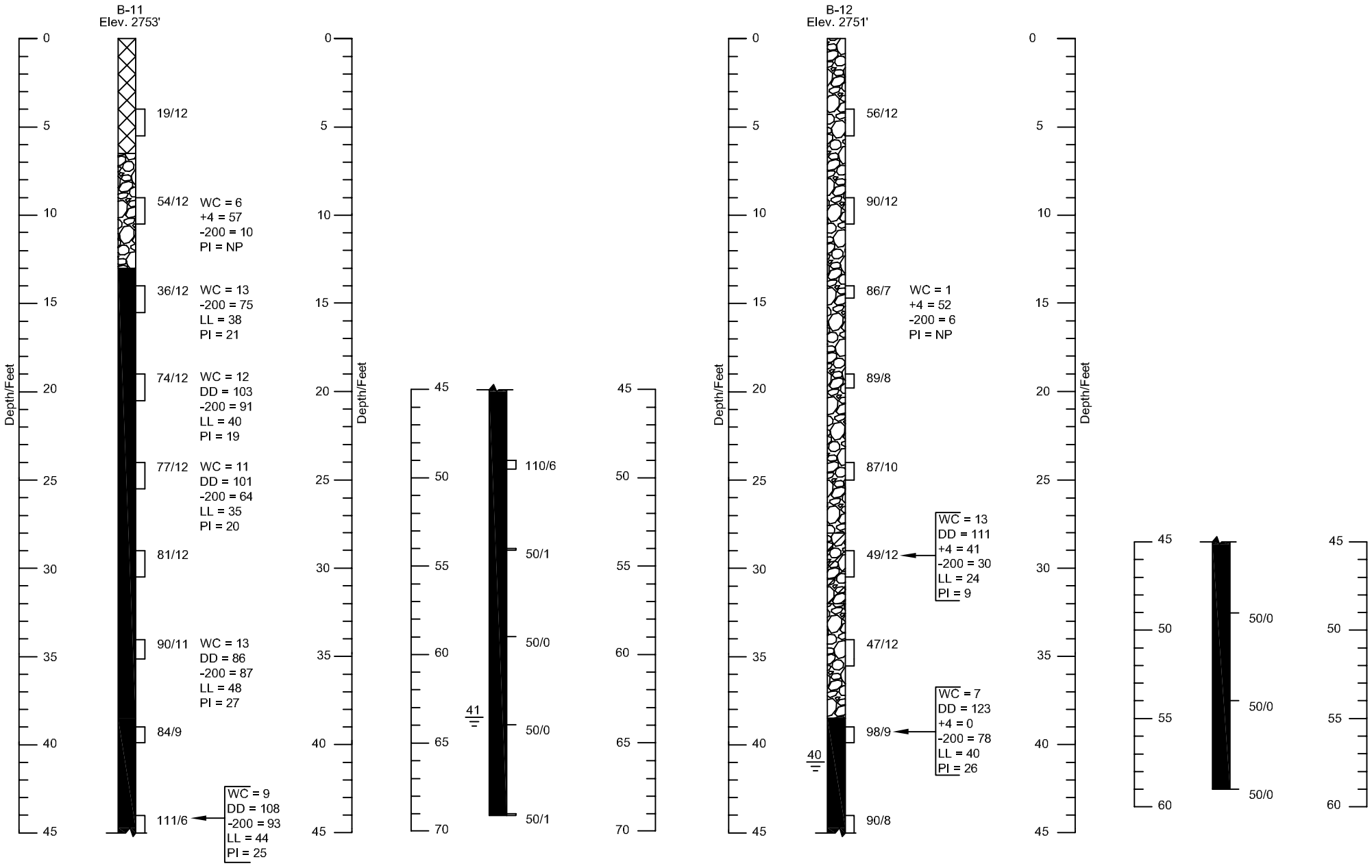
2211499	AGEC	Site Plan	Figure 2



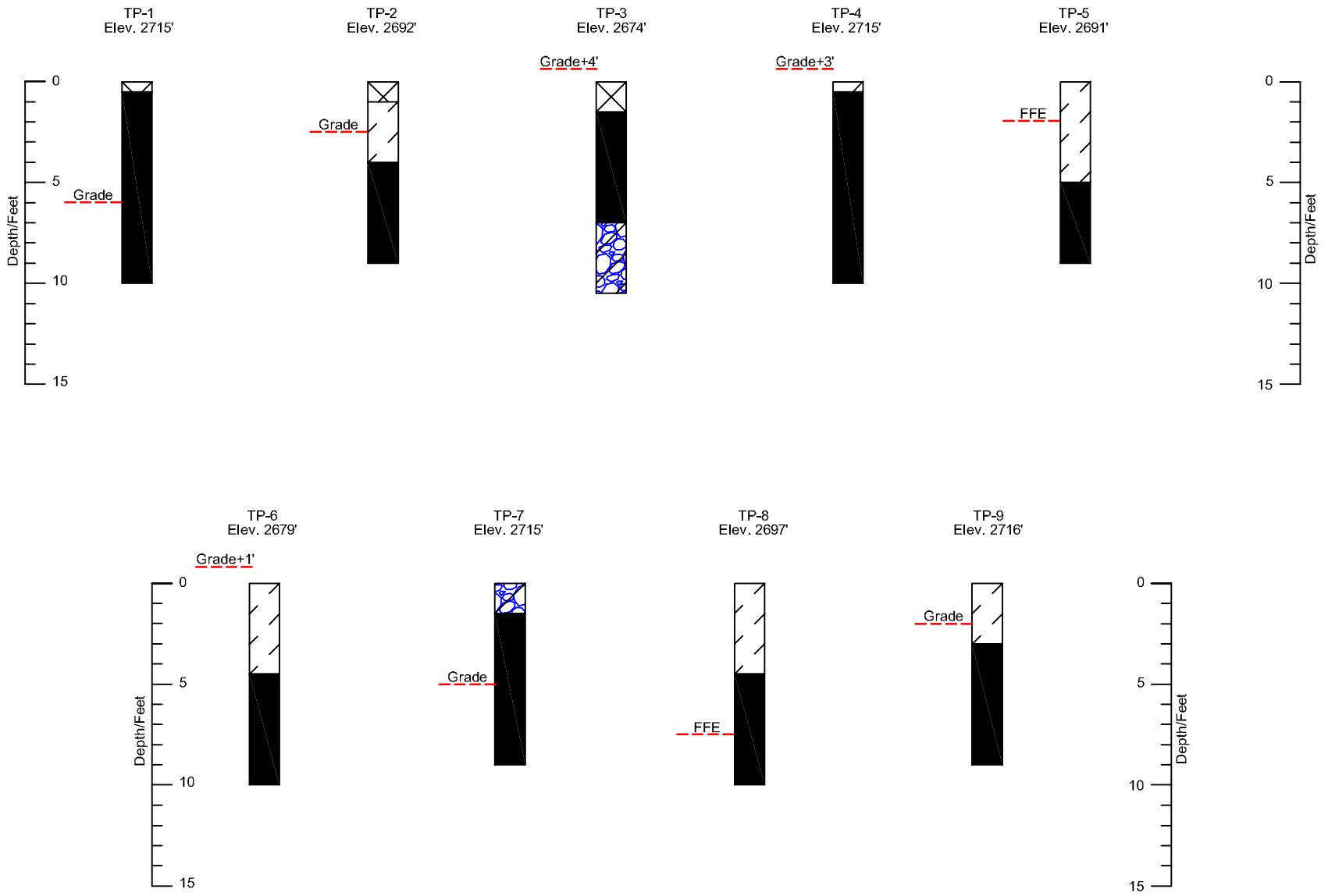
2211499	AGEC	Logs of Exploratory Borings	Figure 3



2211499	AGEC	Logs of Exploratory Borings	Figure 3



2211499	AGEC	Logs of Exploratory Borings	Figure 5



2211499	AGEC	Logs of Test Pits	Figure 6

LEGEND:

Fill; varies from mudstone to silty gravel, poorly compacted, slightly moist, grey to brown to red.

Sandy Lean Clay with Gravel (CL); stiff, moist, brown to grey.

Clayey Gravel (GC); dense, generally in few feet above mudstone, moist, grey.

Silty Gravel with Sand (GM); dense to hard, contains cobbles site gravel, generally sub-rounded, dry to wet, grey.

Sandstone Bedrock; moderately hard, fine to medium grained, grey to brown.

Mudstone Bedrock; consists of lean to fat clay (blue clay), moderately to highly plastic, moist, grey to purple to red.

California drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates slotted 1 inch PVC pipe installed in the boring to the depth shown.

Indicates disturbed sample taken.

Indicates the depth to free water and the number days after excavation the measurement was taken.

NOTES:

1. Borings B-1 to B-10 were drilled on July 19 and 20, 2023 with a truck mounted drill rig equipped with 8-inch hollow-stem augers. Borings B-11 and B-12 were drilled on March 26 and 27, 2024. The test pits were excavated on July 19, 2021 with a rubber tired backhoe.
2. The locations of the borings and test pits were measured by a hand held GPS.
3. The elevations of the borings and test pits were determined by interpolation between contours on the site plan provided.
4. The boring and test pit locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the logs represent the approximate boundaries between material types and the transitions may be gradual.
6. Free water was encountered in the boring B-7 at the time of drilling at the depth shown.
7. WC = water content (%);
   DD = dry density (pcf);
   +4 = percent retained on the No. 4 sieve;
   -200 = percent passing No. 200 sieve;
   LL = liquid limit (%);
   PI = plasticity index (%);

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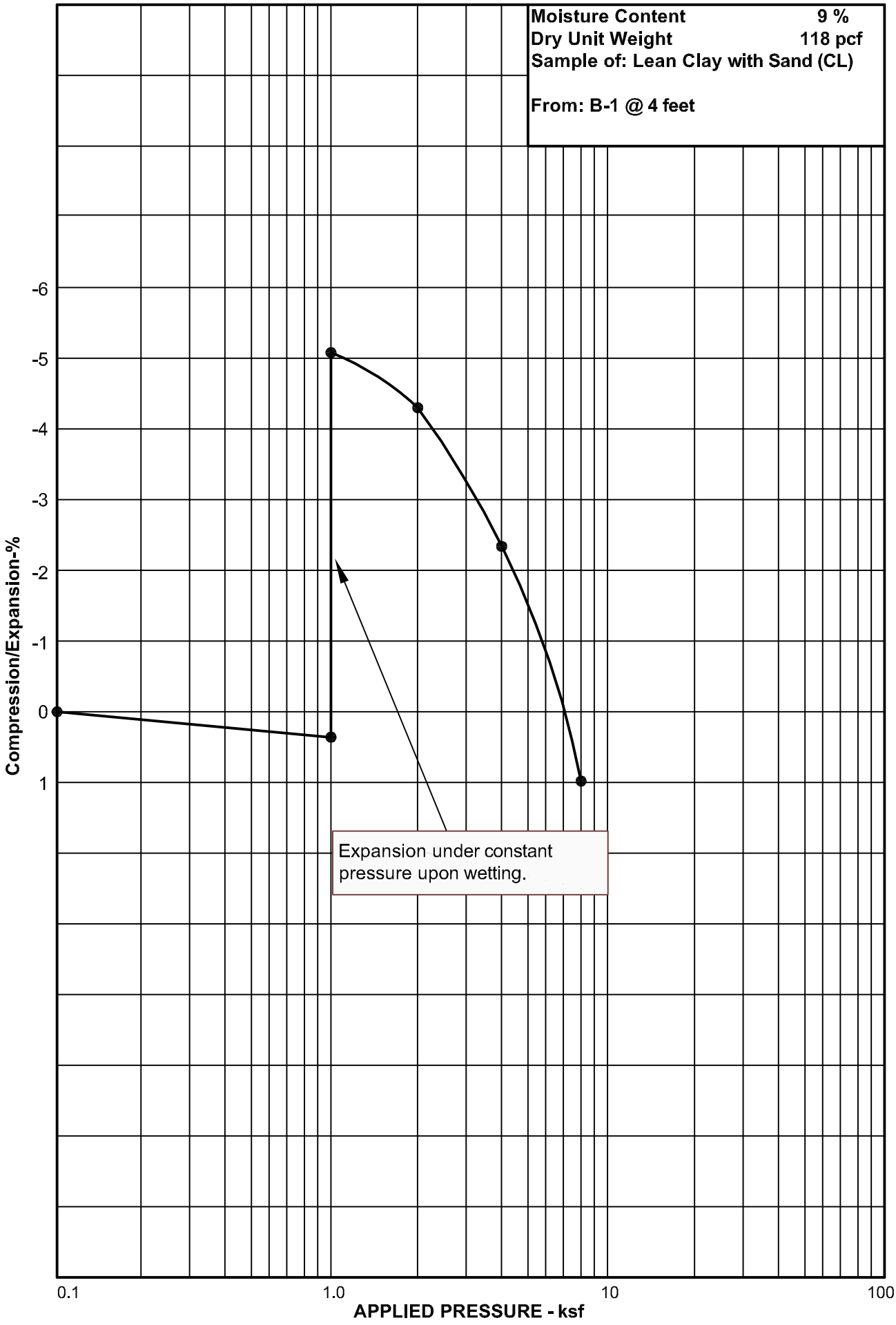

Project No. 2211499 **CONSOLIDATION TEST RESULTS** **Figure 8**

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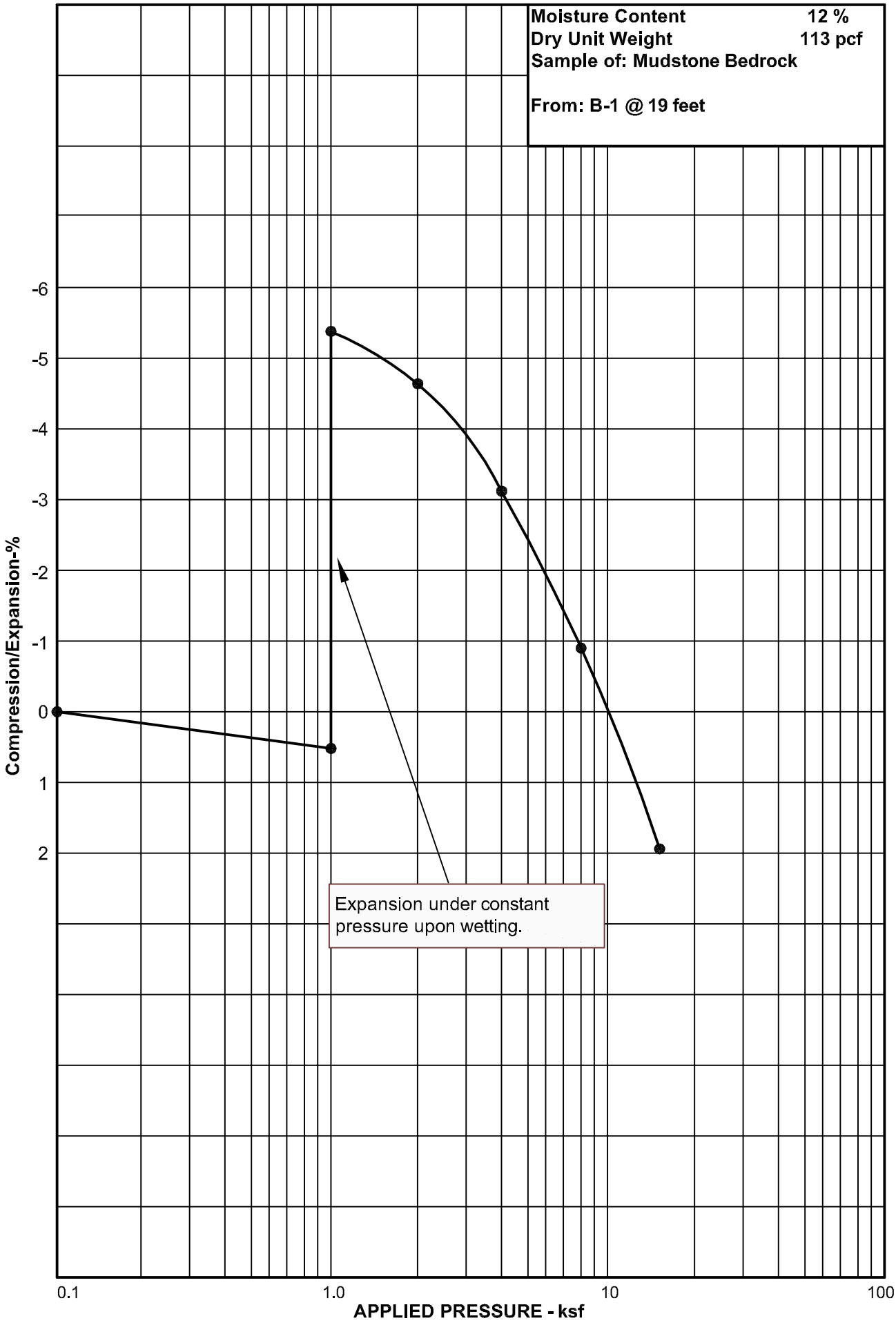
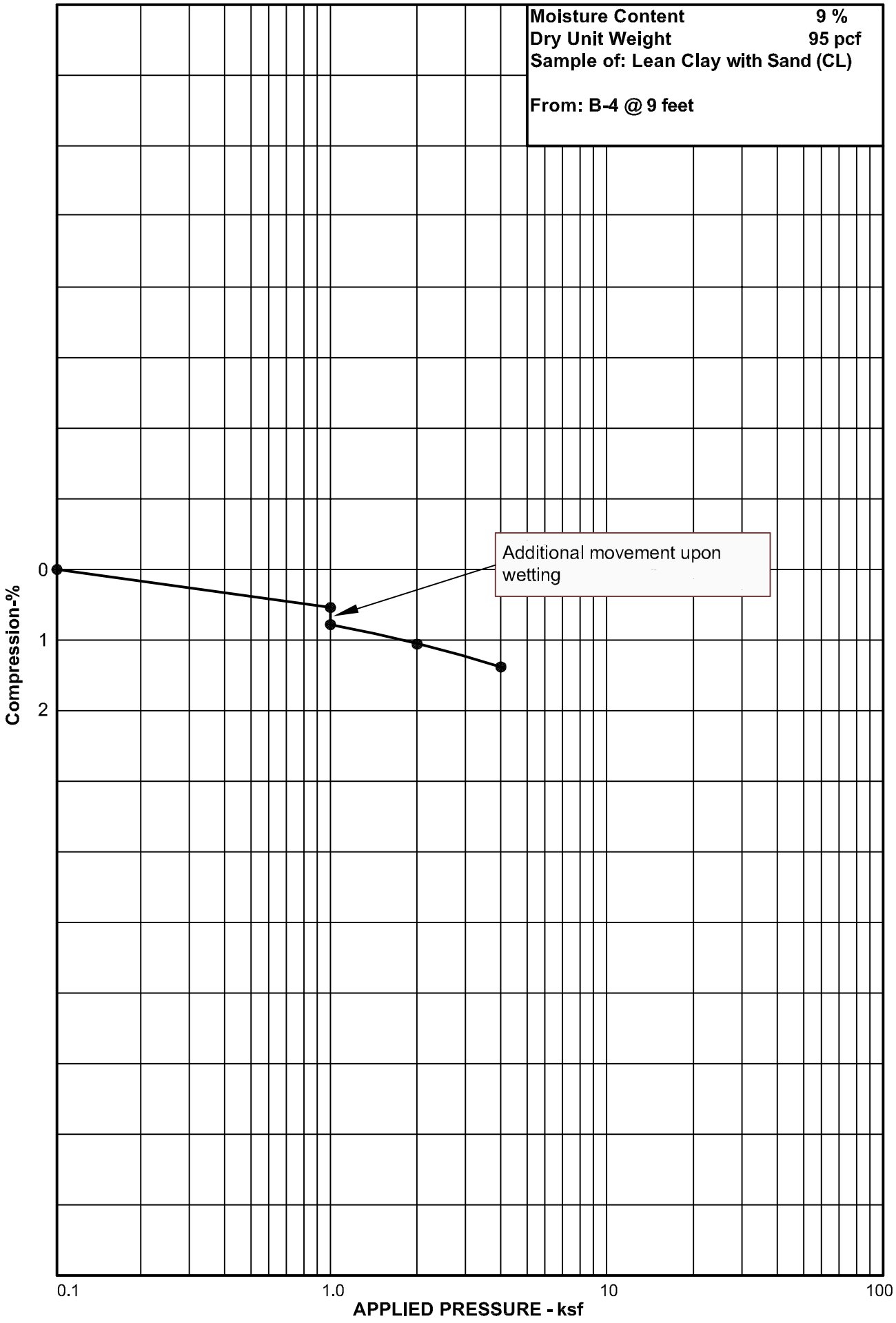


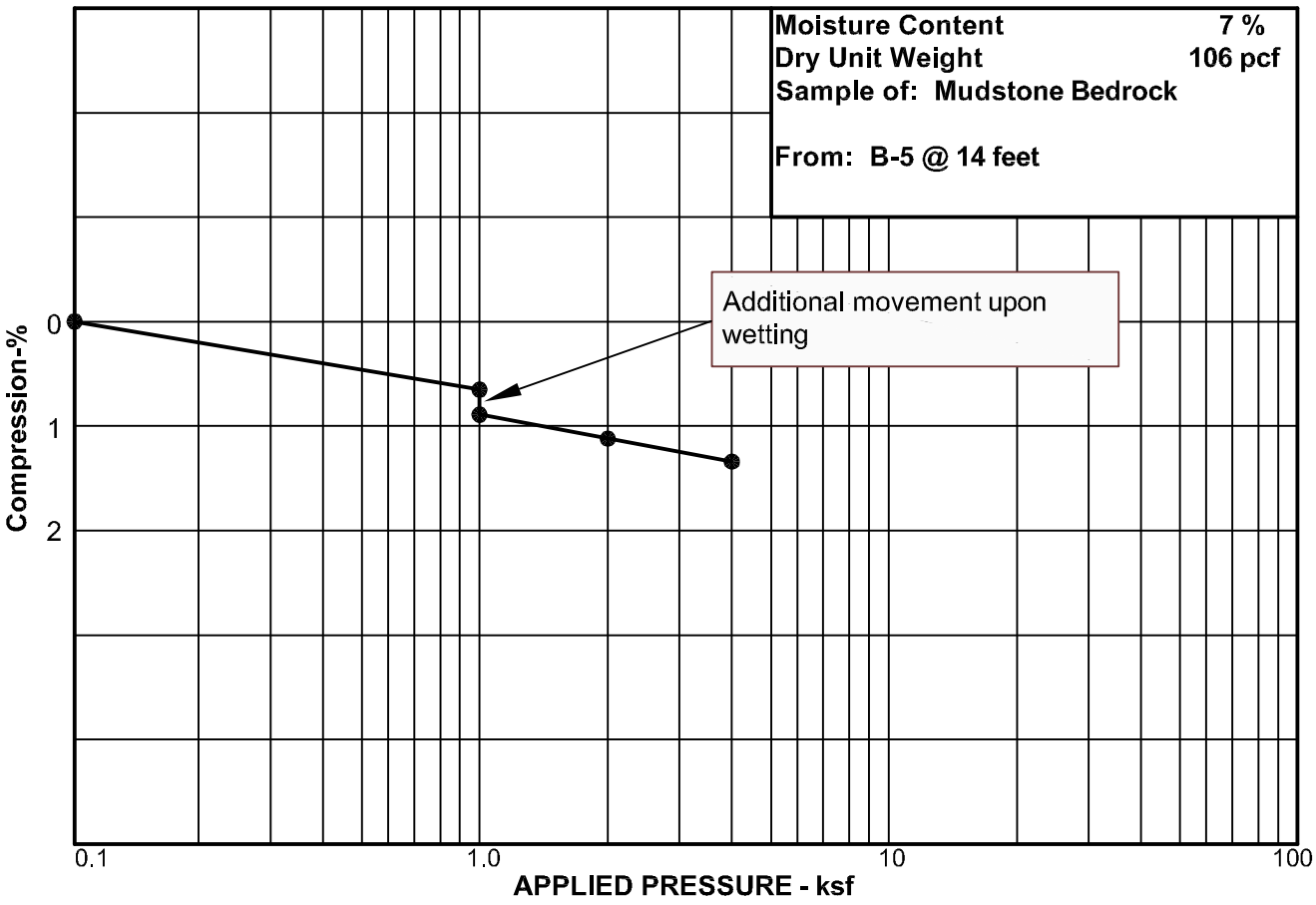
Project No. 2211499 **CONSOLIDATION TEST RESULTS** **Figure 9**

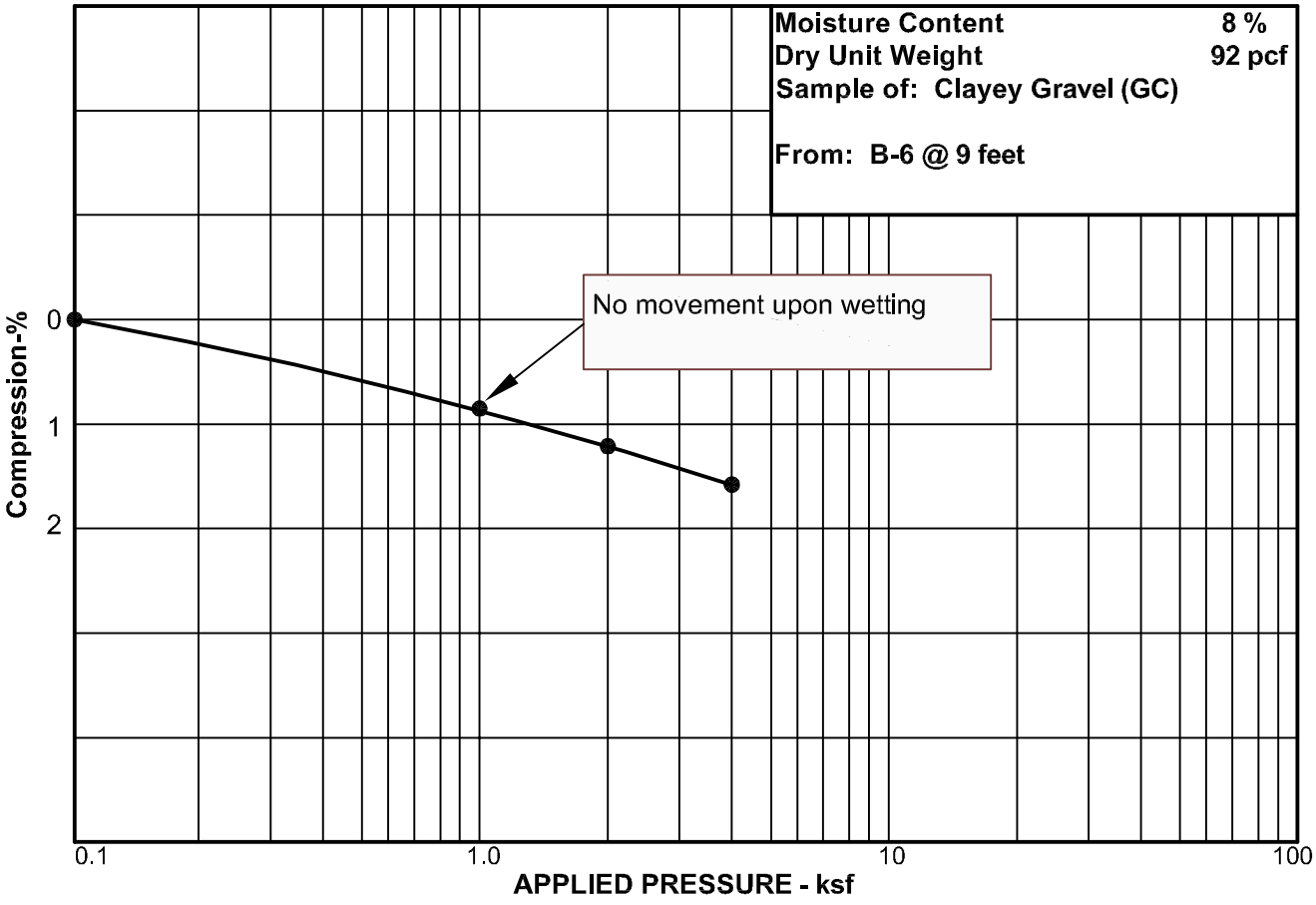
Applied Geotechnical Engineering Consultants, Inc.



Project No. 2211499 CONSOLIDATION TEST RESULTS Figure 10

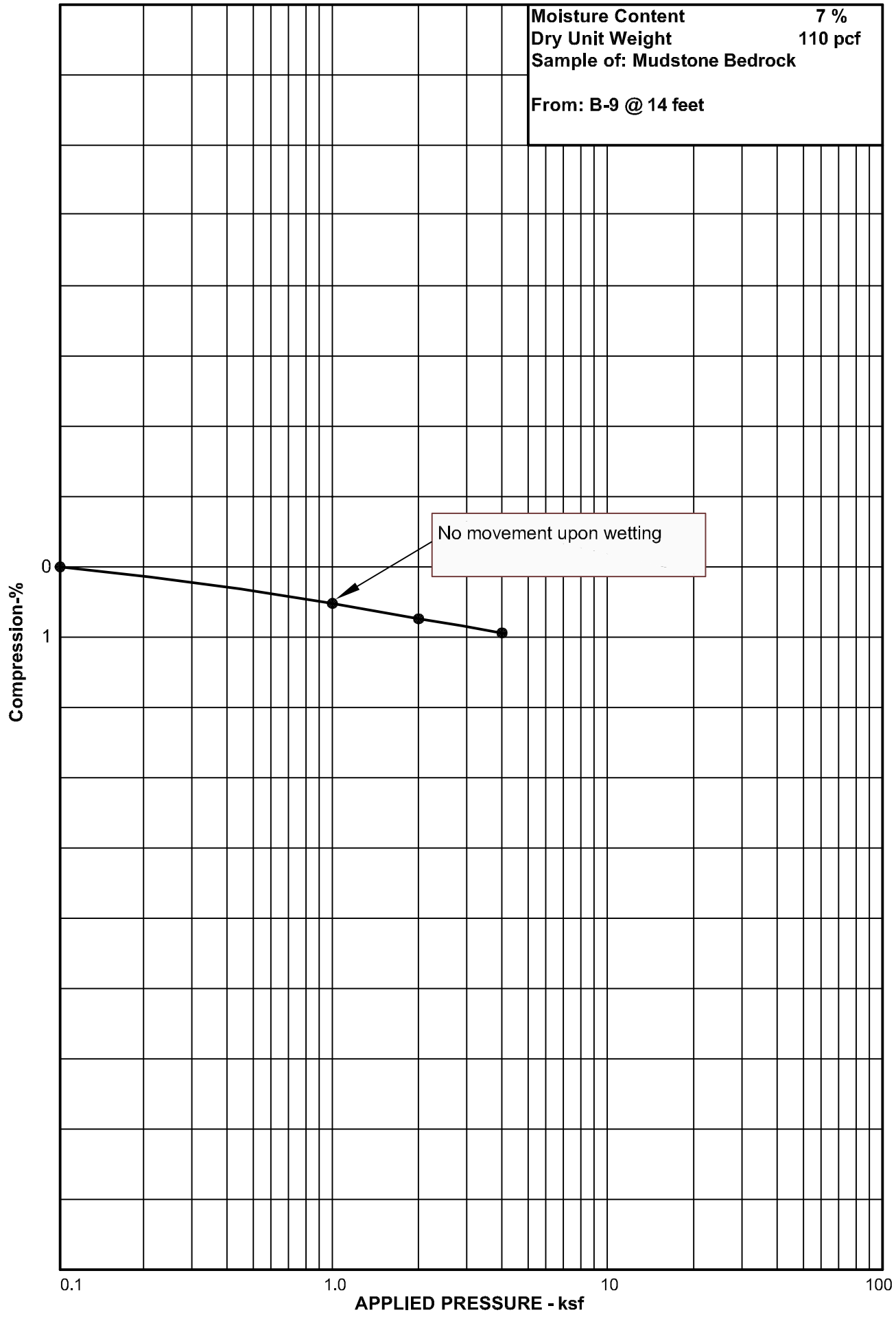
Applied Geotechnical Engineering Consultants, Inc.





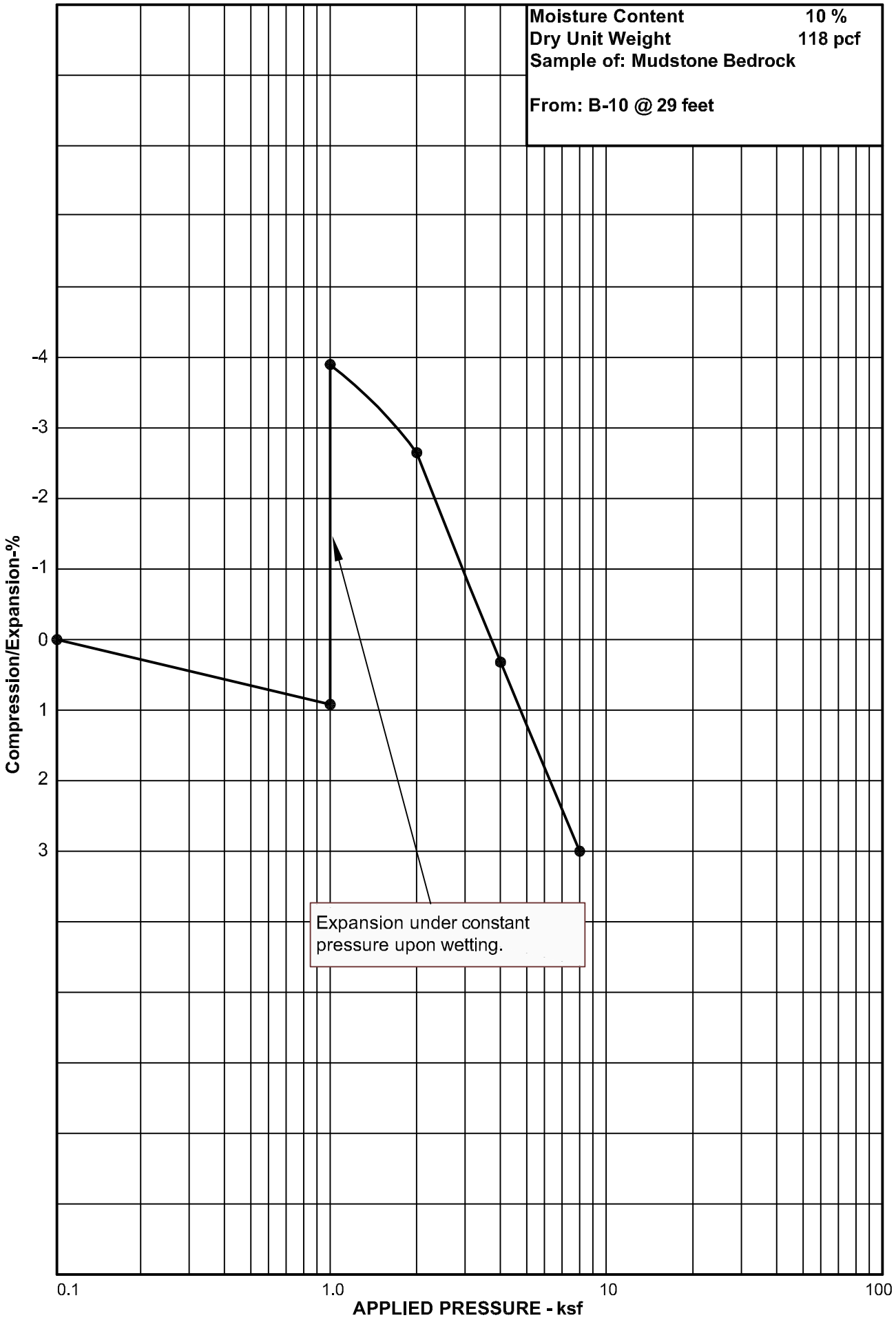
Project No. 2211499 **CONSOLIDATION TEST RESULTS** **Figure 11**

Applied Geotechnical Engineering Consultants, Inc.



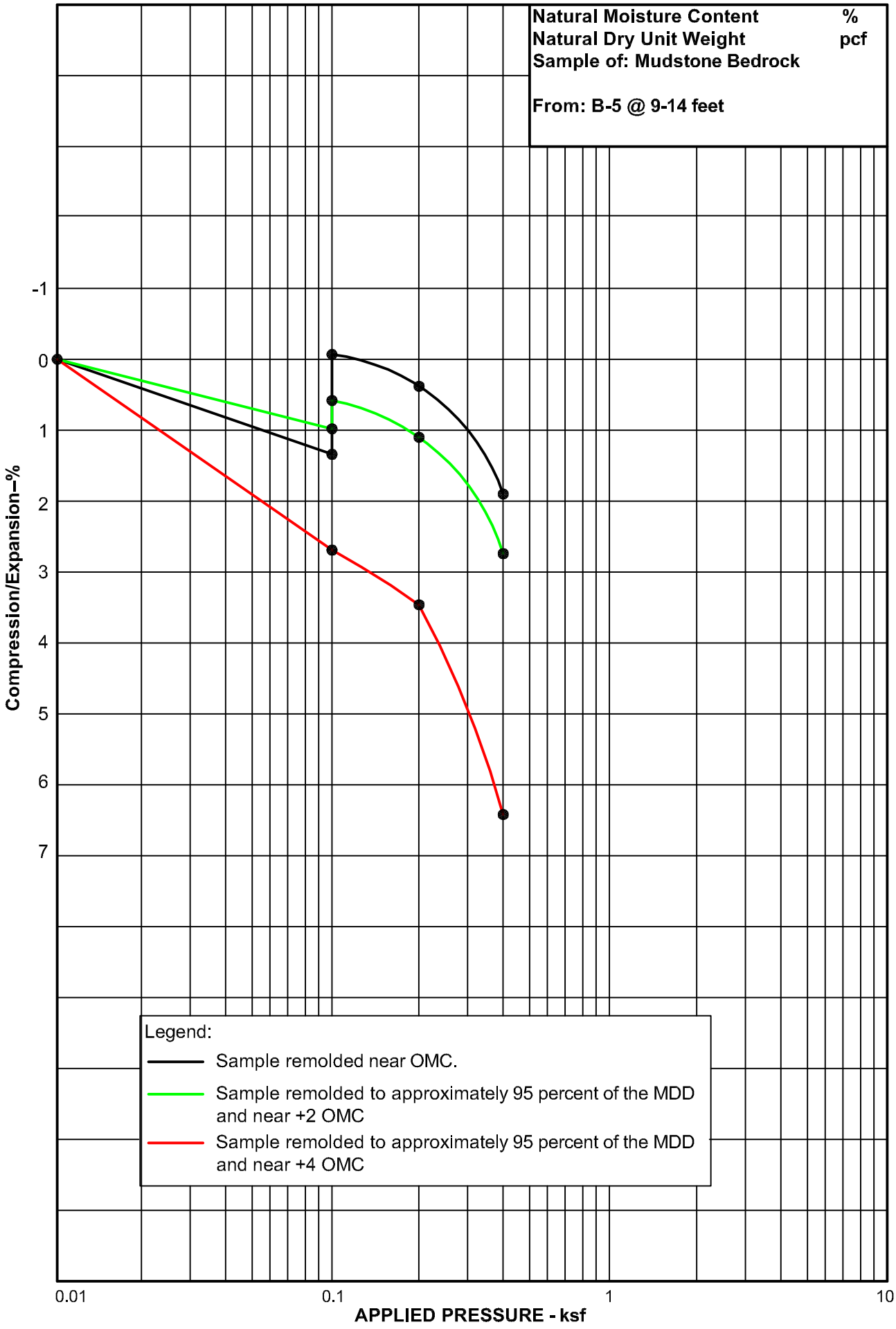
Project No. 2211499 **CONSOLIDATION TEST RESULTS** Figure 12

Applied Geotechnical Engineering Consultants, Inc.



Project No. 2211499 **CONSOLIDATION TEST RESULTS** **Figure 13**

Applied Geotechnical Engineering Consultants, Inc.



Project No. 2211499 **CONSOLIDATION TEST RESULTS** **Figure 14**

AGEC
Applied GeoTech

SIEVE ANALYSIS TEST REPORT
Quality Control

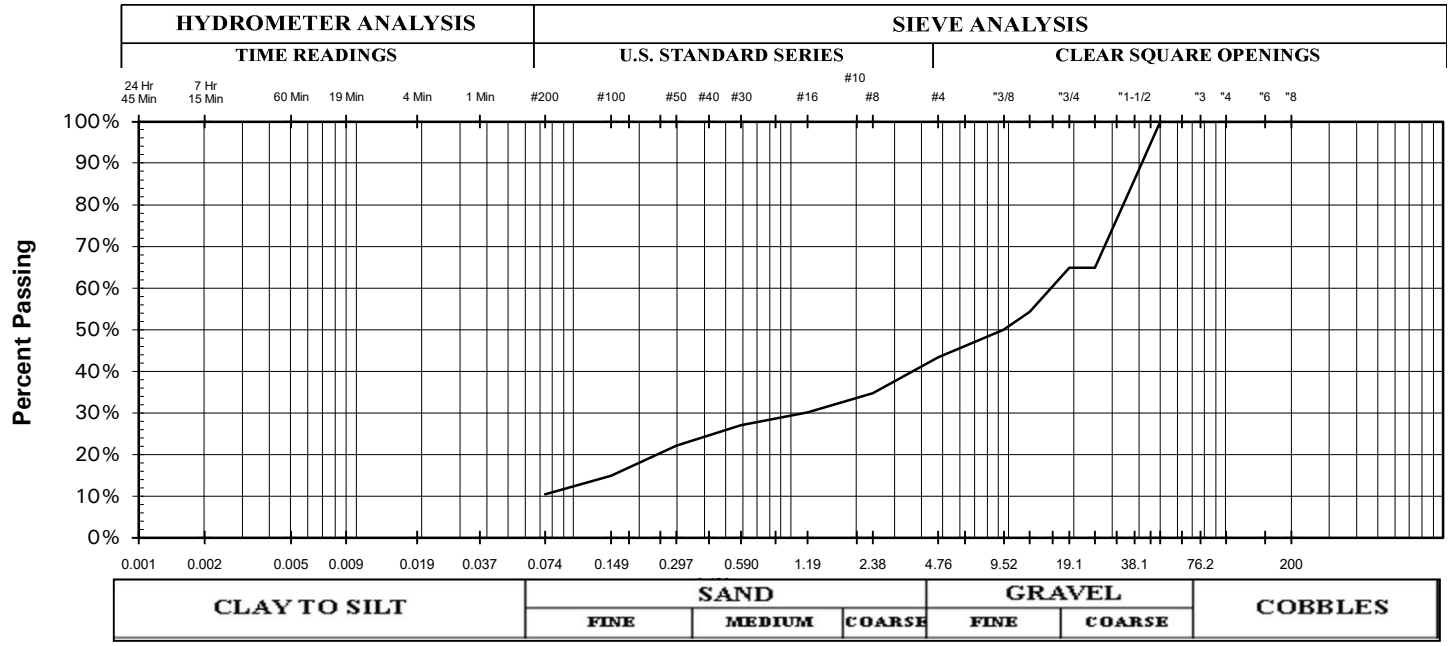
Sample Date:	5/17/24	Lab Number:	
Project Number:	2211499	Sampled By:	
Project Name:	Canyon View Property	Tested By:	LAB
Client:	Shakespeare Development Group		

Sample Location: B-11 @ 9'
Supplier:
Aggregate Size:

Gradation		Atterberg Limits	
Gravel:	57%	Liquid Limit:	
Sand:	33%	Plasticity Index:	Non-Plastic
Silt & Clay:	10%		

USCS Classification: well-graded gravel with silt and sand (GW - GM)

Reviewed By: TT



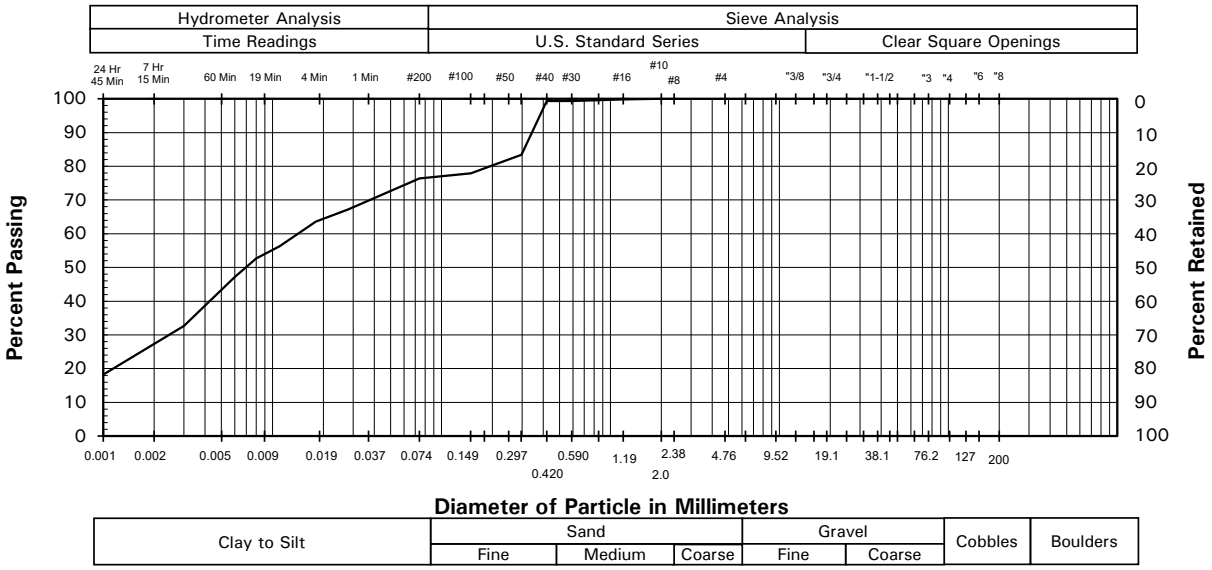
GRADATION CURVE

Figure: 16

Applied GeoTech

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

Project Number: 2211499
Project Name: Canyon View Property
Boring: B-11
Depth: 19'



Gravel:	0%	Liquid Limit:	38%
Sand:	24%	Plasticity Index:	21%
Silt and Clay:	76%	Sample Location:	Boring: - B-11 @ 19'

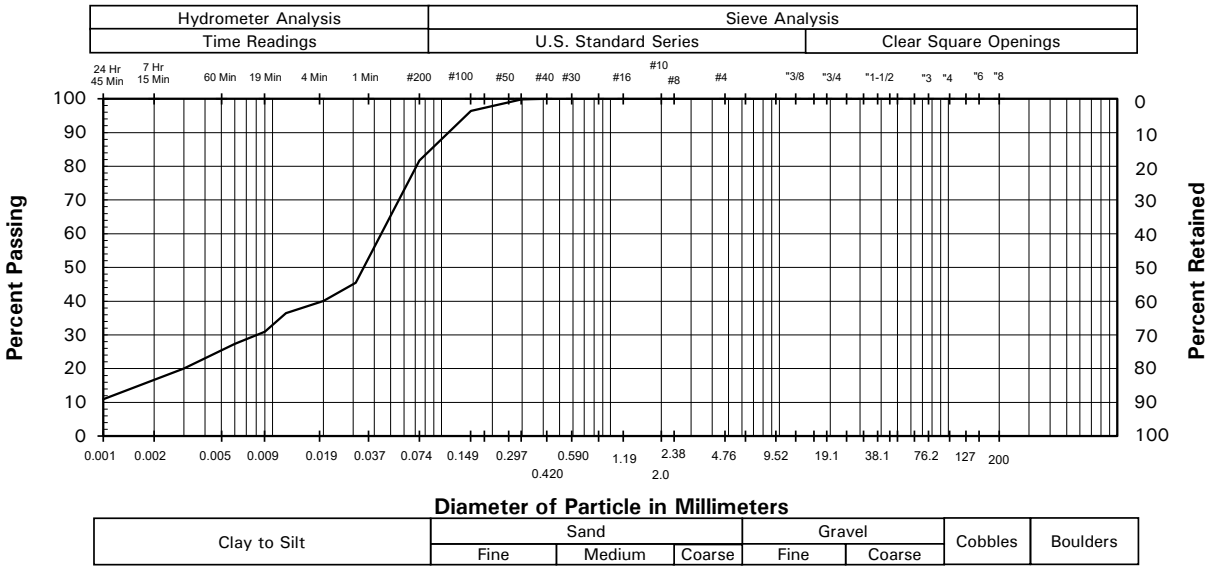
Sample Description: Lean clay (CL)

Project No. 2211499 **GRADATION TEST RESULTS** Figure 17

Applied GeoTech

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

Project Number: 2211499
Project Name: Canyon View Property
Boring: B-11
Depth: 34



Gravel:	0%	Liquid Limit:	48%
Sand:	18%	Plasticity Index:	27%
Silt and Clay:	82%	Sample Location:	Boring: - B-11 @ 34

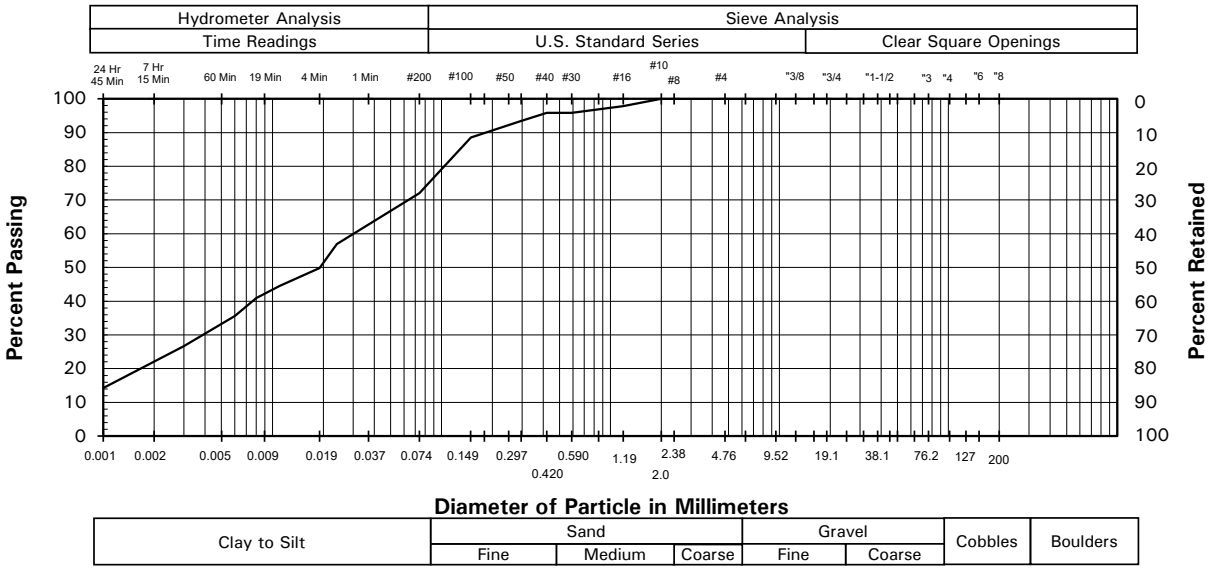
Sample Description: Lean clay (CL)

Project No. 2211499 **GRADATION TEST RESULTS** Figure 18

Applied GeoTech

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

Project Number: 2211499
Project Name: Canyon View Property
Boring: B-12
Depth: 39



Gravel:	0%	Liquid Limit:	40%
Sand:	28%	Plasticity Index:	26%
Silt and Clay:	72%	Sample Location:	Boring: - B-12 @ 39

Sample Description: Lean clay (CL)

Project No. 2211499 **GRADATION TEST RESULTS** Figure 19

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

Canyon View Apartments

Project Number 2211499

Sample Location		Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limits		Moisture-Density Relationship		Sample Classification
Boring No.	Depth (feet)			Gravel (%)	Sand (%)	Silt/ clay (%)	Liquid Limit (%)	Plasticity Index (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	
B-1	4	9	118	3	16	81	44	30			Lean Clay with Sand (CL)
B-1	9	5	99								Sandstone Bedrock
B-1	14	7	108			94	38	22			Mudstone Bedrock
B-1	19	12	113			91	38	17			Mudstone Bedrock
B-2	9	10	87	4	20	76	29	13			Fill; Lean Clay with Sand (CL)
B-2	19	5	107			92	36	20			Mudstone Bedrock
B-4	9	9	95	2	15	83	40	22			Lean Clay with Sand (CL)
B-5	9	5	108			75	30	15			Mudstone Bedrock
B-5	14	7	106			84	32	16			Mudstone Bedrock
B-5	9-14			3	27	70	38	21	115.0	14.0	Mudstone Bedrock
B-6	9	8	92	16	31	53	30	15			Clayey Gravel (GC)
B-6	14	15	101	14	26	60	28	16			Clayey Gravel (GC)
B-7	9	9	102			91	38	19			Mudstone Bedrock
B-8	9	4	116			65	32	16			Mudstone Bedrock
B-8	14	7	109			85	42	27			Mudstone Bedrock

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

Canyon View Apartments

Project Number 2211499

Sample Location		Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limits		Moisture-Density Relationship		Sample Classification
Boring No.	Depth (feet)			Gravel (%)	Sand (%)	Silt/ clay (%)	Liquid Limit (%)	Plasticity Index (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	
B-8	19	7	109			88	43	22			Mudstone Bedrock
B-9	14	7	110				33	18			Mudstone Bedrock
B-10	9	7	115								Mudstone Bedrock
B-10	29	10	118				57	29			Mudstone Bedrock
B-11	9	6		57	33	10		NP			Well Graded Gravel with Silt and Sand
B-11	14	13				75	38	21			Mudstone Bedrock
B-11	19	12	103			91	40	19			Mudstone Bedrock
B-11	24	11	101			64	35	20			Mudstone Bedrock
B-11	34	13	86			87	48	27			Mudstone Bedrock
B-11	44	9	108			93	44	25			Mudstone Bedrock
B-12	14	1		52	42	6		NP			Poorly Graded Gravel with Silt and Sand (SP)
B-12	29	13	111	41	29	30	24	9			Clayey Gravel with Sand (GC)
B-12	39	7	123	0	22	78	40	26			Mudstone Bedrock

ST. GEORGE HILLSIDE REVIEW BOARD MINUTES
NOVEMBER 20, 2024, 9:00 A.M.
ON SITE

PRESENT:

Hillside Review Board Chair, James Sullivan
Board Member, Jeff Mathis
Board Member, Russ Owens
Board Member, Dave Black
Board Member, Kevin Holyoak

EXCUSED:

STAFF MEMBERS PRESENT:

Assistant Public Works Director, Wes Jenkins
Community Development Director, Carol Winner
Planner, Dan Boles
Planner, Brett Hamilton
City Landscape Architect, Mark Goble
Development Office Supervisor, Monica Smith
Assistant City Attorney, Daniel Baldwin

OTHERS PRESENT:

Jack de Ryk, Rosenberg Associates
Floyd Jackson, Contractor
William Haggerty, Property Owner
Dave Nasal, Applicant
Dwain Schallenberger, Applicant
Eric McFadden, Premier Design
Ben Shakespeare, Shakespeare Development
Chad Buce, Straightline Architecture
Kim Town, Shakespeare Development
Nephi Hammon, Shakespeare Development
Rick Meyer, Bush & Gudgell
Wayne Rogers, AGEC

Link to Call to Order by Chair Sullivan: 00:00:00

HILLSIDE DEVELOPMENT PERMIT:

Consider a request for a Hillside Development Permit to allow disturbance of areas in the 20-30%, 30-40% and 40%+ slope areas and review possible construction in a rockfall hazard overlay area. Applicant – Bush and Gudgell – Representative – Rick Meyer - Case No. 2024-HS-004 – ON SITE.

BACKGROUND AND RECOMMENDATION: This is a request to obtain a hillside permit for the property located at Canyon View Dr and Ostler Way. The applicants are proposing to build a new apartment development on this property. This property is in the hillside overlay. **Case No. 2024-HS-004** (Staff – Brett Hamilton).

Link to comment by Bush and Gudgell representative, Rick Meyer, describing the project and background information, including discussion between Board Members and Mr. Meyer: 00:00:47

Link to question by Assistant Public Works Director, Wes Jenkins, including discussion between Mr. Jenkins and Mr. Meyer: 00:01:35

Link to question by Ben Shakespeare, including discussion between Wes Jenkins and Mr. Shakespeare: 00:01:46

Link to comment by Ben Shakespear, including discussion between Board Members, Rick Meyer, Chad Buce, Wes Jenkins, and Mr. Shakespeare: 00:01:58

Link to question by Board Member Mathis, including discussion between Board Members and Rick Meyer: 00:05:13

Link to comment by Board Member Black, including discussion between Board Members, Community Development Director, Carol Winner, Wes Jenkins and Rick Meyer: 00:07:00

Link to exhibit distributed by Board Member Black [Exhibit]

Link to comment by Ben Shakespeare, including discussion between Board Members and Mr. Shakespeare: 00:12:42

Link to question by Chair Anderson, including discussion between Board Members, Ben Shakespeare, and Wes Jenkins: 00:14:27

Link to comment by Board Member Black, including discussion between Board Members, Ben Shakespeare, and Wes Jenkins: 00:18:10

Link to comment by Wayne Rogers, including discussion between Board Members, Ben Shakespeare, and Wes Jenkins: 00:20:22

Link to comment by Wayne Rogers, including discussion between Board Members, Rick Meyer, Ben Shakespeare, Wes Jenkins, City Attorney, Daniel Baldwin, and Mr. Rogers: 00:31:43

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Link to motion: 00:38:39

MOTION:

A motion was made by Board Member Black to table this until the next meeting and they can address the slope map and the disturbance area percentages and provide some more detail of the construction in the western corner of the site.

SECOND:

The motion was seconded by Board Member Mathis.

VOTE:

Chair Sullivan called for a vote, as follows:

Chair Sullivan – aye
Board Member Mathis – aye
Board Member Owens – aye
Board Member Black – aye
Board Member Holyoak – aye

The vote was unanimous and the motion carried

HILLSIDE DEVELOPMENT PERMIT:

Consider a request for a Hillside Development Permit to allow the applicant to cut into the (20-40%+) hillside for access to a proposed townhome development. The hillside cut would also allow construction of the northern portion of the townhome site. The applicant has provided a slope analysis, proposed drainage report and site layout for construction. The applicant is Premier Design & Engineering, Inc. and the representative is Eric McFadden. Case No. 2024-HS-014– ON SITE.

BACKGROUND AND RECOMMENDATION: The northern portion of the property has slopes that are in the 20-40%+ range. When Riverside Drive was constructed in approximately 2005 some of those slopes were disturbed to make room for the road. The Willow Bend Townhomes project was previously approved by the City Council in April 2021. The previous approvals have expired so the project is being re-processed. **Case No. 2024-HS-014** (Staff – Brett Hamilton).

Link to Board Member Mathis recusing himself: 00:00:33 [Recording 2]

Link to comment by applicant, Eric McFadden explaining the project, including discussion between Board Members and Mr. McFadden: 00:01:00

Link to question by Board Member Owens, including discussion between Board Members and Eric McFadden: 00:02:42

Link to comment by Chair Sullivan, including discussion between Board Members and Eric McFadden: 00:04:45

Link to comment by Board Member Black, including discussion between Board Members and Eric McFadden: 00:06:12

Link to comment by Board Member Owens, including discussion between Board Member and Eric McFadden: 00:07:54

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Link to motion: 00:14:28

MOTION:

A motion was made by Board Member Black to recommend this for approval with the same recommendations as before.

SECOND:

The motion was seconded by Board Member Owens.

VOTE:

Chair Sullivan called for a vote, as follows:

Chair Sullivan – aye
Board Member Black – aye
Board Member Owens – aye
Board Member Holyoak – aye

The vote was unanimous and the motion carried

HILLSIDE DEVELOPMENT PERMIT:

Consider a request for a Hillside Development Permit to adjust the location of the ridgeline and ridgeline setback on lot 44 of the Foremaster Ridge subdivision in anticipation of the construction of a residential home. The applicants are Jack de Ryk and Floyd Jackson. Case No. 2024-HS-010– ON SITE.

BACKGROUND AND RECOMMENDATION: This is a request to obtain a hillside permit for the property located at 1856 E. Joe Cir (Lot 44, Foremaster Ridge). This location is a residential neighborhood, and the applicant would like to build a house on this lot. The rear of the applicant's property abuts the ridge line of Foremaster Ridge. The applicant is requesting to review the location of the 30-foot ridgeline setback as shown on the final plat for Foremaster Ridge lot 44 and establish a ridgeline which the applicant feels is more indicative of the actual ridgeline. This application came before Planning Commission once before on August 27, 2024, at which time the Planning Commission recommended that the City Council approve the ridgeline as proposed by the Hillside Review Board. On October 23, 2024, the Hillside Review Board (HSRB) reviewed the application again and recommended the same coordinates for the ridgeline. The applicant would like the chance to present additional information to the HSRB. **Case No. 2024-HS-014** (Staff – Dan Boles).

Link to comment by Board Member Black, including discussion between Mr. Black and City Attorney, Daniel Baldwin: 00:00:33 [Recording 3]

Link to comment by applicant, Jack de Ryk introducing the project, including discussion between Board Members and Mr. de Ryk: 00:01:12

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Link to motion and discussion on the motion: 00:04:57

MOTION:
A motion was made by Board Member Black to approve the curvilinear ridgeline that's been shown on the plan and that the setback of the proposed residence as appropriate.

SECOND:
The motion was seconded by Board Member Owens.

VOTE:
Chair Sullivan called for a vote, as follows:

Chair Sullivan – aye
Board Member Black – aye
Board Member Mathis – aye
Board Member Owens – aye
Board Member Holyoak – aye

The vote was unanimous and the motion carried

APPROVAL OF MINUTES:
Approval of the meeting minutes from the October 23, 2024 meeting.

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Link to motion: 00:00:06 [Recording 4]

MOTION:
A motion was made by Board Member Owens to approve the minutes.

SECOND:
The motion was seconded by Board Member Black.

VOTE:
Chair Sullivan called for a vote, as follows:

Chair Sullivan – aye
Board Member Black – aye
Board Member Mathis – aye
Board Member Owens – aye
Board Member Holyoak – aye

ADJOURN:
Link to move to adjourn: 00:00:17

MOTION:
A motion was made by Board Member Mathis to adjourn.

SECOND:
The motion was seconded by Board Member Black.

VOTE:

Chair Sullivan called for a vote, as follows:

Chair Sullivan – aye
Board Member Black – aye
Board Member Mathis – aye
Board Member Owens – aye
Board Member Holyoak – aye

The vote was unanimous and the motion carried.

/s/Monica Smith
_____
Monica Smith, Secretary